VOL. XV. No. 9. SEPTEMBER 1930.

MECCANO MAGAZINE

OPENING OF THE LIVERPOOL AND MANCHESTER RAILWAY (see page 674).

6D

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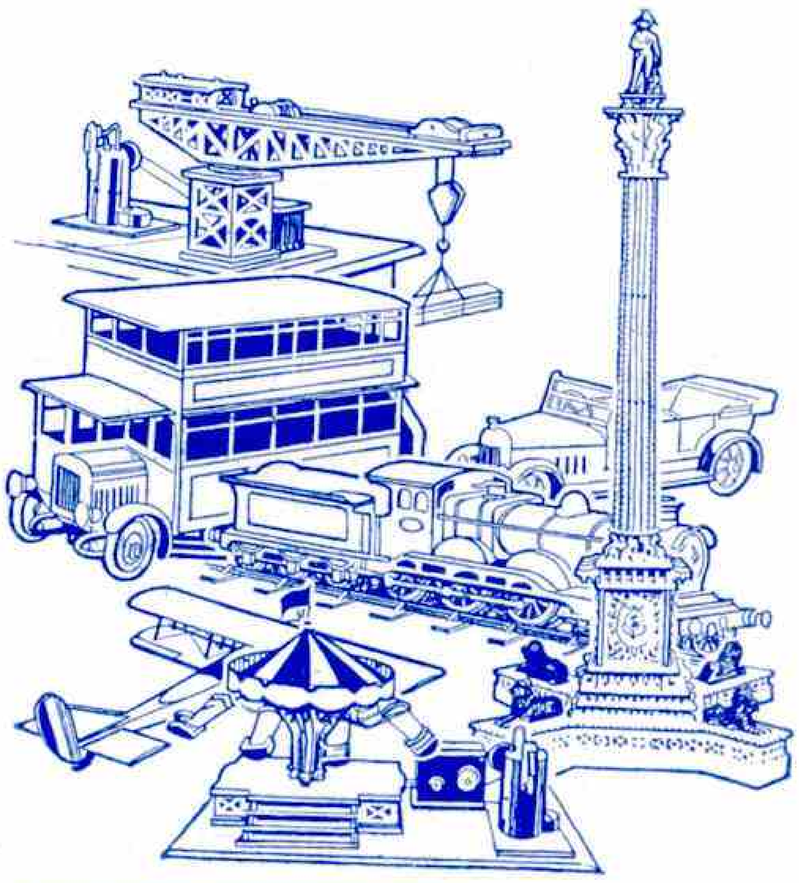

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NEXT MONTH: WORLD'S LARGEST TRANSFORMERS. PUBLISHED: 1st OCTOBER

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September, 1930

With the Editor

Sir Horace Smith-Dorrien

Last month a motor accident led to the death of General Sir Horace L. Smith-Dorrien, one of Britain's veteran soldiers. His career as a soldier extended over almost 50 years, for he joined the army as long ago as 1876, and did not retire until 1923. During that time he saw fighting in France, South Africa and Egypt and on the north-west frontier of India. Before he was 21 years of age he narrowly escaped death at the hands of the Zulus who had massacred a British force at Isandlwhana, and later he was in the thick of equally savage fighting in other parts of the world. It is strange that after a lifetime of exposure to danger of all kinds he should die as the result of an accidental collision in a quiet English country lane.

To most people Sir Horace is chiefly known for the battle that he fought during the great retreat from Mons in 1914. He was then Commander of one of the two British Army Corps engaged in the fighting, and when his troops reached Le Cateau he was faced with a terrible responsibility. Harassed by their pursuers, his men were too tired to go any farther and everything pointed to a great disaster overtaking them. His orders were to continue to retreat, but it was certain that if he did so his men would be overwhelmed and scattered by the far more numerous pursuers. The only way of saving the situation seemed to be to turn on his pursuers and strike them such a blow that they would recoil and give him opportunity to pursue his way southward unmolested.

The risk of such a course was tremendous. Sir Horace knew that failure to beat the enemy would lead to the complete ruin of the entire army, and probably would be almost a fatal blow to the Allied Cause. With the true soldier's instinct, however, and relying completely on his men to give a good account of themselves he boldly decided to fight, and his little corps, too weary to march, but not too tired to fight, took up position in order to face the advancing Germans.

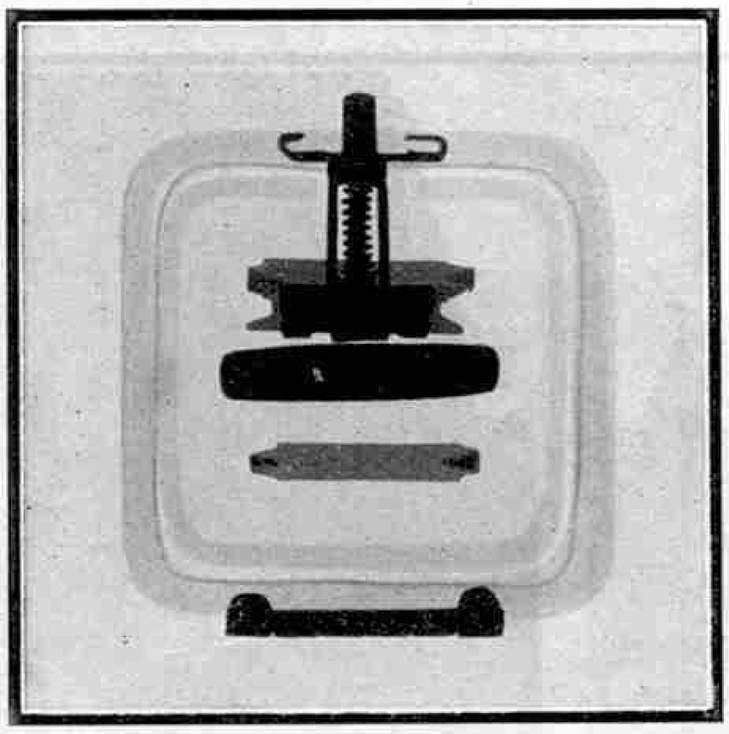
Battle that Saved the Allies

The amazing courage displayed at this crisis was fully justified by the result. The end of the fierce fighting was that the pursuing enemy were repulsed with heavy losses, and were so staggered by the sudden resistance to their forward movement that they believed themselves to be confronted by a much larger force than they had expected. The result was that their plan to outflank and destroy the British force was completely foiled.

At the time the magnitude of Sir Horace's achievement was scarcely realised, but year by year the conviction has grown that his decision to stand and fight at Le Cateau was one of the outstanding feats of the War. The more we learn about the events leading up to the battle, and of the conditions under which it was fought, the greater becomes our admiration for the courage and boldness of the man who made the decision. No doubt one of the reasons that prompted his decision was his confidence in his officers and men. He was always a "soldier's General." In all his various commands he trusted his men, and in return he won their respect and confidence.

Before the outbreak of the War Sir Horace was in charge at Aldershot, and it is now generally recognised that his splendid work in training the men who afterwards formed the Expeditionary Force was largely responsible for the splendid fighting qualities of the "Old Contemptibles." Illness prevented him from playing any great part in the later years of the War, but he is one of the few of those who took part in the early operations whose reputations have grown more secure as the story of the great struggle has become better known.

No. 22. WHAT EVER IS IT?



Here is the twenty-second puzzle in the popular series of mystery photographs. Can you identify this mysterious looking object?

To the first reader to send an exact answer or, if nobody is successful in this, to the one who gets nearest, I will send an autographed copy of my book "Wonders of Engineering."

Solutions should be written on postcards only and addressed "Editorial Competition, No. 22, 'Meccano Magazine,' Old Swan, Liverpool." Closing date 30th September.

This Month's Railway Centenary

On the 13th of this month begin the celebrations of the hundredth anniversary of the opening of the Liverpool and Manchester Railway. These will continue until 20th September, and a wonderfully interesting programme has been prepared for the benefit of the thousands of visitors who no doubt will be attracted to Liverpool during the ten days of the celebrations.

I have referred to this unique event in previous issues, and it is not necessary for me to do more than to remind readers who are interested in railways that it will give them an opportunity of seeing the most modern types of locomotives and rolling stock, in addition to interesting relics of the pioneer days of the Iron Road. There will also be a great exhibition of models and interesting objects and documents connected with the railway, and a wonderful pageant that will illustrate the story of transport throughout the ages. The story will be depicted by 2,500 performers on a huge outdoor stage, the curtain of which will be 300 ft. in length.

In all parts of the country special facilities for travelling to Liverpool are being offered, and I remind my readers that the scene of the celebrations is near the Meccano factory. A hearty welcome and an interesting time awaits all those who come to make a tour of the works during Pageant week.

August Mystery Photograph

Surprisingly few competitors hit on the correct solution of Mystery Photograph No. 21—the interior view of the tower of a ruined castle, which actually was that at Conway. The first correct solution came from W. Laurie, Birmingham, to whom an autographed copy of my book, "*Wonders of Engineering*," has been sent.

The Triumph *of the* Steam Locomotive

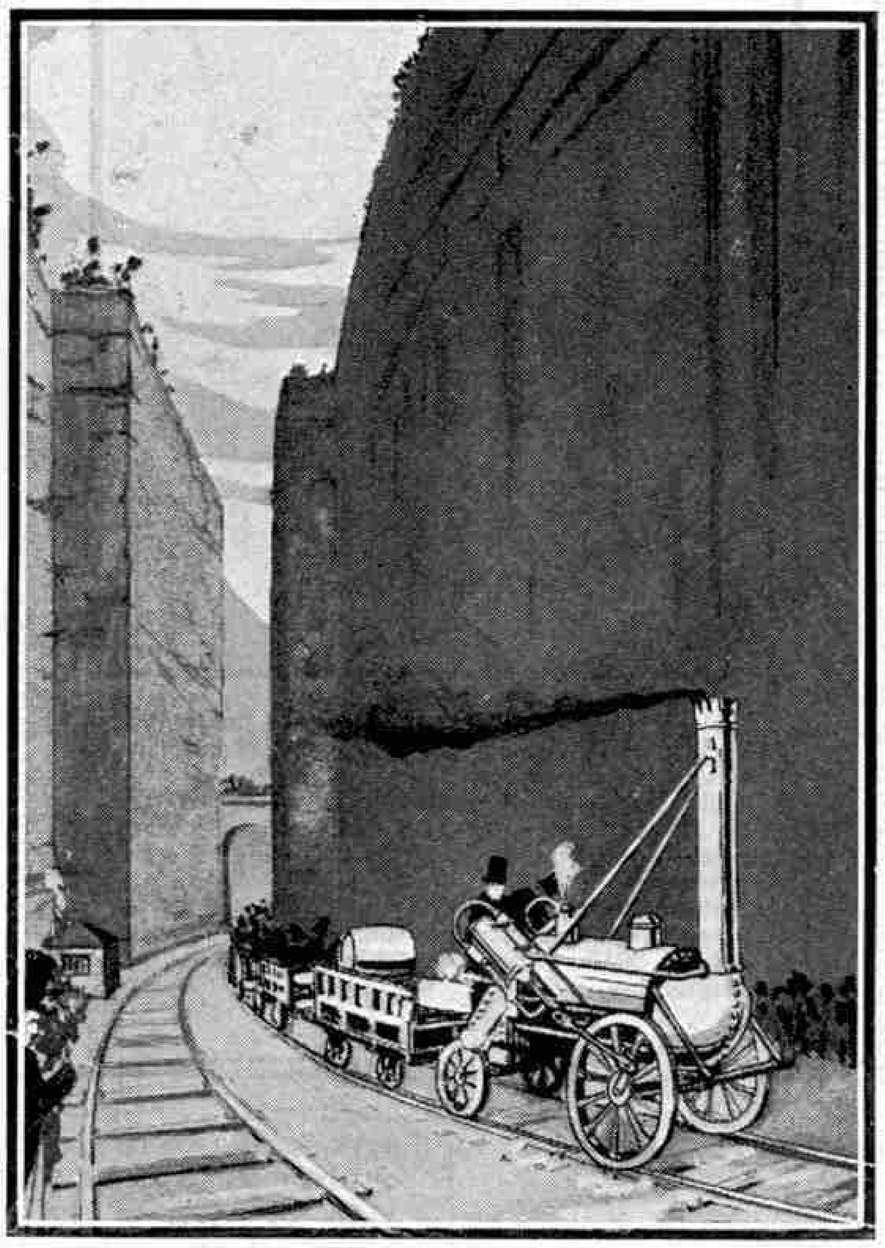
LIVERPOOL & MANCHESTER RAILWAY OPENED

A MEMORABLE DAY

THE opening of the Liverpool and Manchester Railway on 15th September, 1830, marked the real beginning of the world's railway development. In our article on page 678 we have seen how the line was successfully constructed in the face of many difficulties and great opposition. In this article we shall show how the steam locomotive triumphed over its competitors and asserted the position of pre-eminence which, after the lapse of a century, it still holds.

The Liverpool and Manchester Railway was intended primarily for goods traffic, the carrying of passengers being regarded merely as a possible side line. Some of the directors favoured the employment of horses to haul the wagons of merchandise, while others considered that stationary engines and a system of strong wire ropes were the best solution to the problem. The steam locomotive provided a third possibility, but a very unpopular one. Several meetings of the directors were held to discuss the system of haulage, but no agreement could be reached. This caused serious delay, and finally the directors, in order to take the matter further, visited some of the Northumberland and Durham colliery railways where horses were employed for haulage work. They were quickly convinced that horse haulage would be quite inadequate to deal with the large amount of traffic they anticipated for the Liverpool and Manchester line, and the problem was now whether stationary engines or locomotives should be adopted. At this point George Stephenson, the engineer of the company, began to give the directors the benefit of his views. His experiences in the North of England had made him a firm believer in the locomotive, and he never lost an opportunity of pointing out its advantages. Some of the directors were then appointed to visit the Stockton and Darlington Railway to inspect the locomotives there in use, and also the fixed engines working at Hetton and Killingworth. They returned to Liverpool with a great deal of information, but their personal opinions as to the relative merits of the two types of engines differed so greatly that the Board were still unable to come to a decision.

Two engineers named respectively Walker and Rastrick, were then commissioned to study and report upon the operation of both fixed engines and locomotives. They reported in favour of fixed engines, and proposed that the railway between Liverpool and Manchester should be divided into 19 stages each about 1½ miles in length, with 21 engines fixed at different points to work the trains forward. Their report was referred to Stephenson but he maintained his belief in the superiority of locomotives. He likened the fixed engine system to "a continuous chain extending between the two termini," and he pointed out that the failing of any link in this chain would derange the whole system. On the other hand a system operated by locomotives resembled a series of unconnected chains, any of which could be altered or replaced without interruption to the traffic. The directors were impressed by Stephenson's earnestness and argument, and they decided early in 1829 to offer a prize of £500 for a locomotive capable of fulfilling certain conditions.



Olive Mount Cutting in 1830.

The conditions laid down were as follows :—

1.—"The said Engine must 'effectually consume its own smoke,' according to the provision of the Rail-way Act, 7th Geo. IV.

2.—"The Engine, if it weighs Six Tons, must be capable of drawing after it, day by day, on a well-constructed Rail-way, on a level plane, a Train of Carriages, of the gross weight of Twenty Tons, including the Tender and Water Tank, at the rate of Ten Miles per Hour, with a pressure of steam in the boiler not exceeding 50 lb. on the square inch.

3.—"There must be two Safety Valves, one of which must be completely out of the reach or control of the Engine-man, and neither of which must be fastened down while the Engine is working.

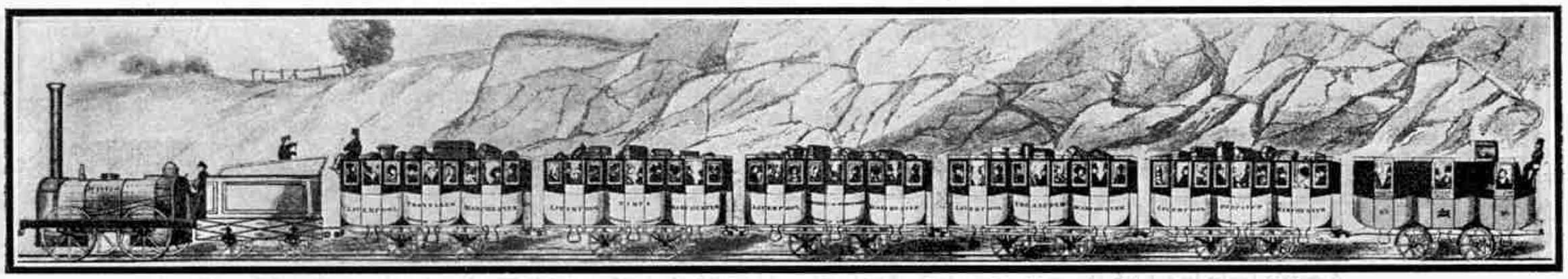
4.—"The Engine and Boiler must be supported on Springs, and rest on Six Wheels; and the height, from the ground to the top of the Chimney, must not exceed Fifteen Feet.

5.—"The weight of the Machine, *with its complement of water* in the Boiler, must, at most, not exceed Six Tons; and a machine of less weight will be preferred if it draw *after* it a *proportionate* weight; and if the weight of the Engine etc. do not exceed *Five Tons*, then the gross weight to be drawn need not exceed Fifteen Tons; and in that proportion for Machines of still smaller weight—provided that the Engine, etc. shall still be on six wheels, unless the weight (as above) be reduced to Four Tons and a Half, or Under, in which case the Boiler, etc. may be placed on four wheels. And the Company shall be at liberty to put the Boiler, Fire Tube, Cylinders, etc. to the test of a pressure of water not exceeding 150 lb. per square inch, without being answerable for any damage the Machine may receive in consequence.

6.—"There must be a Mercurial Gauge affixed to the Machine with Index Rod, showing the Steam Pressure above 45 pounds per square inch; and constructed to blow out at a Pressure of 60 pounds per inch.

7.—"The Engine to be delivered complete for trial at the Liverpool end of the Rail-way, not later than the 1st October next.

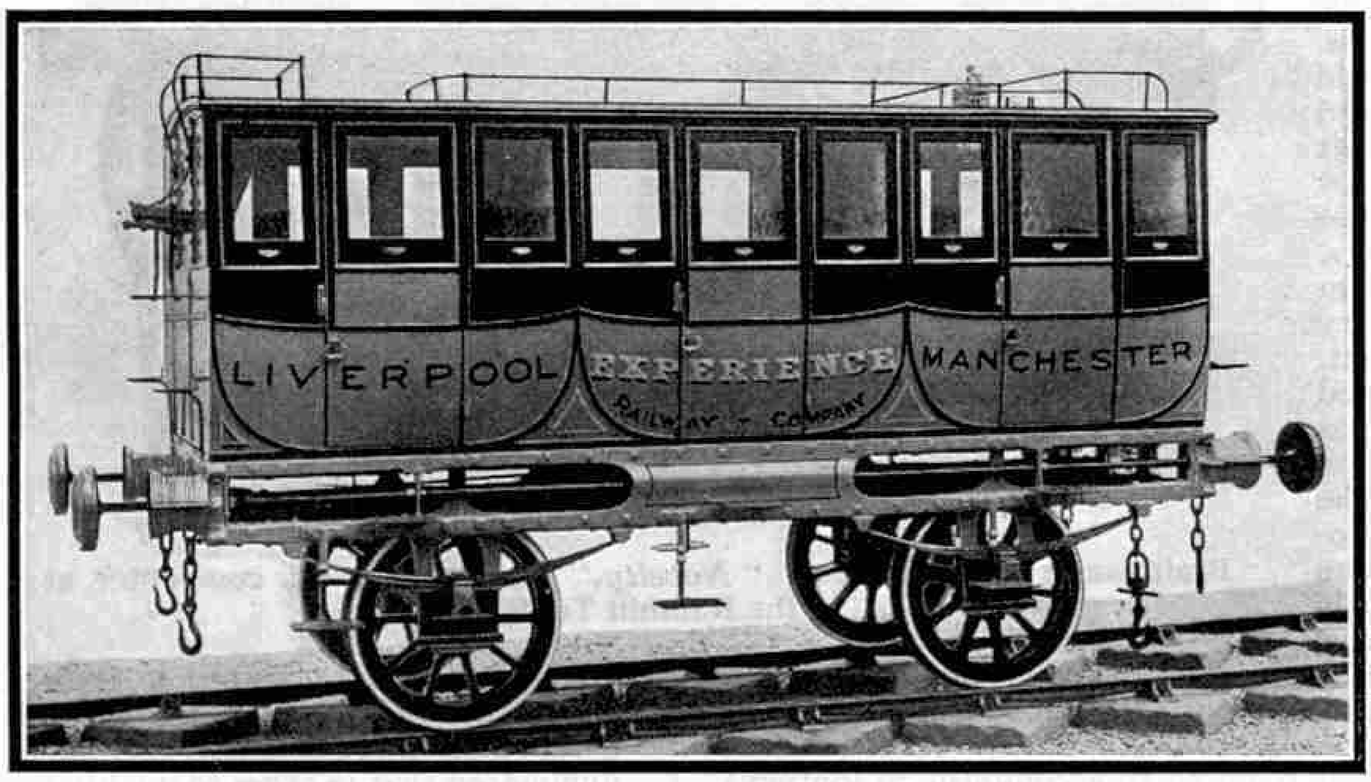
8.—"The price of the Engine, which may be accepted, not to exceed £550, delivered on the Rail-way; and any Engine not approved to be taken back by the Owner."



A train of first class carriages, with the mail, on the Liverpool to Manchester Railway. The coaches all bear names.

The notice of the competition aroused great interest, and engineers in various parts of the country began to design locomotives. Stephenson, aided by his son Robert, who had charge of the Stephenson Locomotive Works at Newcastle, was soon busy evolving a locomotive which, he was confident, would excel that of any rivals. His chief difficulty was in discovering a means of increasing the heating surface of the boiler so that the steam could be raised quickly and continuously, and in sufficient quantity to drive the locomotive at a high speed. In the first engine supplied to the Killingworth Colliery, Stephenson had greatly accelerated combustion in the furnace by diverting the waste steam from the cylinders into the chimney, while in the "*Lancashire Witch*," a locomotive that he used in hauling material for the Liverpool and Manchester Railway embankments, a further improvement was effected by fitting a boiler of greater length, making possible the use of longer tubes. This amended plan, however, caused the engine to weigh about 12 tons, double the weight that would be eligible for the contest.

At this stage Henry Booth, the secretary of the Liverpool and Manchester Railway Company, confided to Stephenson a plan he had devised for the construction of a tubular boiler. The principle of Booth's scheme was to pass the gases from the furnace through a series of narrow tubes in order to distribute the heat over a larger surface of the metal in contact with water. Stephenson saw that the plan offered a solution to the problem, and with Booth's consent he adopted the scheme and worked out its practical details.



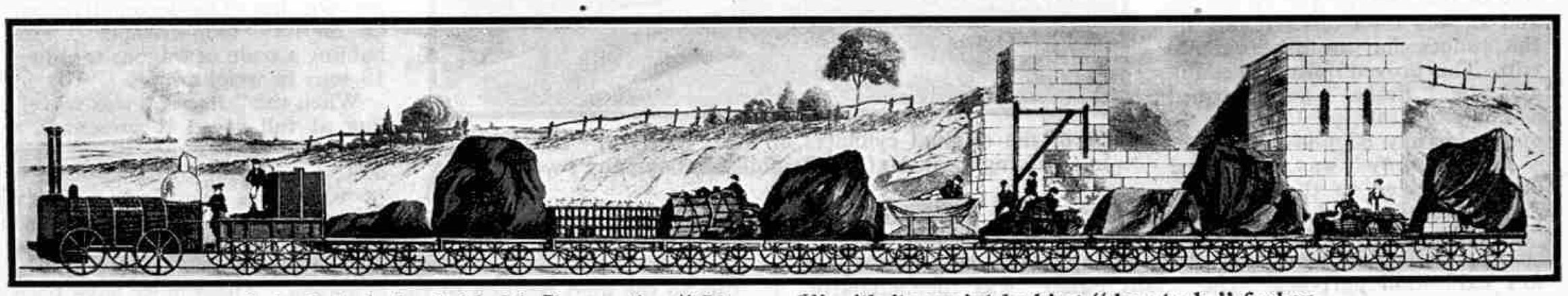
"*Experience*," **a first class coach on the Liverpool and Manchester Railway.**

The locomotive was built at the Newcastle works under the personal supervision of Robert Stephenson, and was named the "*Rocket*." It was of the 0–2–2 type, and had two driving wheels each 4 ft. 8½ in. in diameter, while the trailing wheels were each 2 ft. 6 in. in diameter. The cylinders were situated behind the driving wheels, and practically on a level with the boiler top; and they sloped downward at an angle of 35 degrees in order that the connecting rods might act directly on the single pair of drivers. The boiler was cylindrical in shape with flat ends, the upper half forming a reservoir for the steam, while the lower half contained the necessary water. The lower portion included 25 three-inch diameter copper tubes, each open at one end to the copper fire-box, and at the other end to the chimney. The fire-box resembled in shape a hollow, flat-sided horseshoe, and it was fixed to the end of the boiler by brass screws in order that the hot gases from it might pass through the tubes inside the boiler that led to the chimney. Finally a steam blast was used in order to increase the draught. The mouths of the copper tubes through which the blast escaped were contracted in order to increase the speed at which the steam emerged, and this increased the draught to such a remarkable extent that steam could be raised to a pressure of 50 lb. per sq. in. in less than an hour from the time of lighting the fire. In working order the "*Rocket*" weighed 4¼ tons, and when completed and tested it was despatched in a wagon to Carlisle, from where it was shipped to Liverpool.

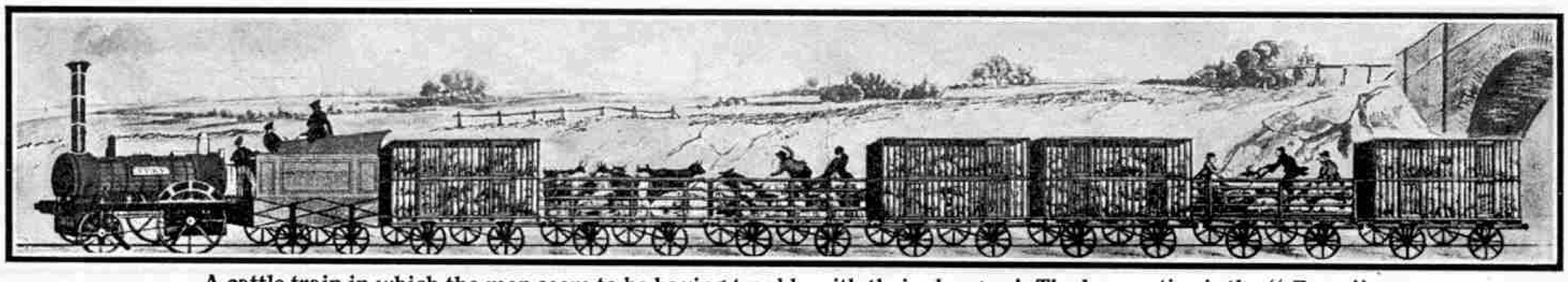
According to the "*Mechanics' Magazine*" of that period ten engines were prepared for the Rainhill contest, but only four actually appeared. These engines were the "*Rocket*"; the "*Sans Pareil*" built by Timothy Hackworth, engine superintendent of the Stockton and Darlington Railway; the "*Novelty*," built in London to the design of the engineers Braithwaite and Ericsson; and the "*Perseverance*," submitted by a man named Burstall, of Leeds. In addition, a weird contrivance named the "*Cyclopede*" was entered by Thomas Shaw Brandeth, one of the directors of the Liverpool and Manchester Railway Company. This vehicle consisted of an endless platform that was moved treadmill-fashion by the feet of one, or sometimes two horses; and naturally it was disqualified before the contest took place.

The "*Sans Pareil*" was a 0–4–0 engine with coupled wheels, 4 ft. 6 in in diameter. The vertical cylinders were 1 ft. 6 in. in length, and seven inches in diameter, and were placed in an inverted position behind the trailing wheels. The boiler was 6 ft. in length, 4 ft. 2 in. in diameter, and had the grate and chimney at the same end, being equipped with a return flue. The engine in working order weighed 4 tons 15 cwt. 2 qr., thus being in excess of the 4½ tons allowed in respect of four-wheeled engines. The competition authorities conceded the extra weight, however, and the "*Sans Pareil*" was allowed to compete.

The "*Novelty*" also was a four-wheeled engine with wheels of 4 ft. 2 in. diameter. The cylinders, each 1 ft. in length by six inches in diameter, were arranged vertically and operated through bell cranks to a crank axle—the first to appear on any locomotive. A boiler 10 ft. in length and 1 ft. 1 in. in diameter was fitted at the rear of the engine, and, says "*The Engineer*," "contained a small tapering flue, which returned on itself twice." The "*Novelty*" was the pioneer of tank locomotives, for both fuel and water were carried on the engine. Coke fuel was inserted through the top of the firebox, and air was driven into the closed ashpan by means of a large bellows. The engine was lighter than either the "*Rocket*"



A goods train hauled by the locomotive "*Liverpool*" with its quaint-looking "haystack" firebox.



A cattle train in which the men seem to be having trouble with their charges ! The locomotive is the "*Fury*."

or the "*Sans Pareil*," being only 3 tons 17 cwt. ; and this low weight probably was due to the locomotive framework being of wood, mounted upon springs.

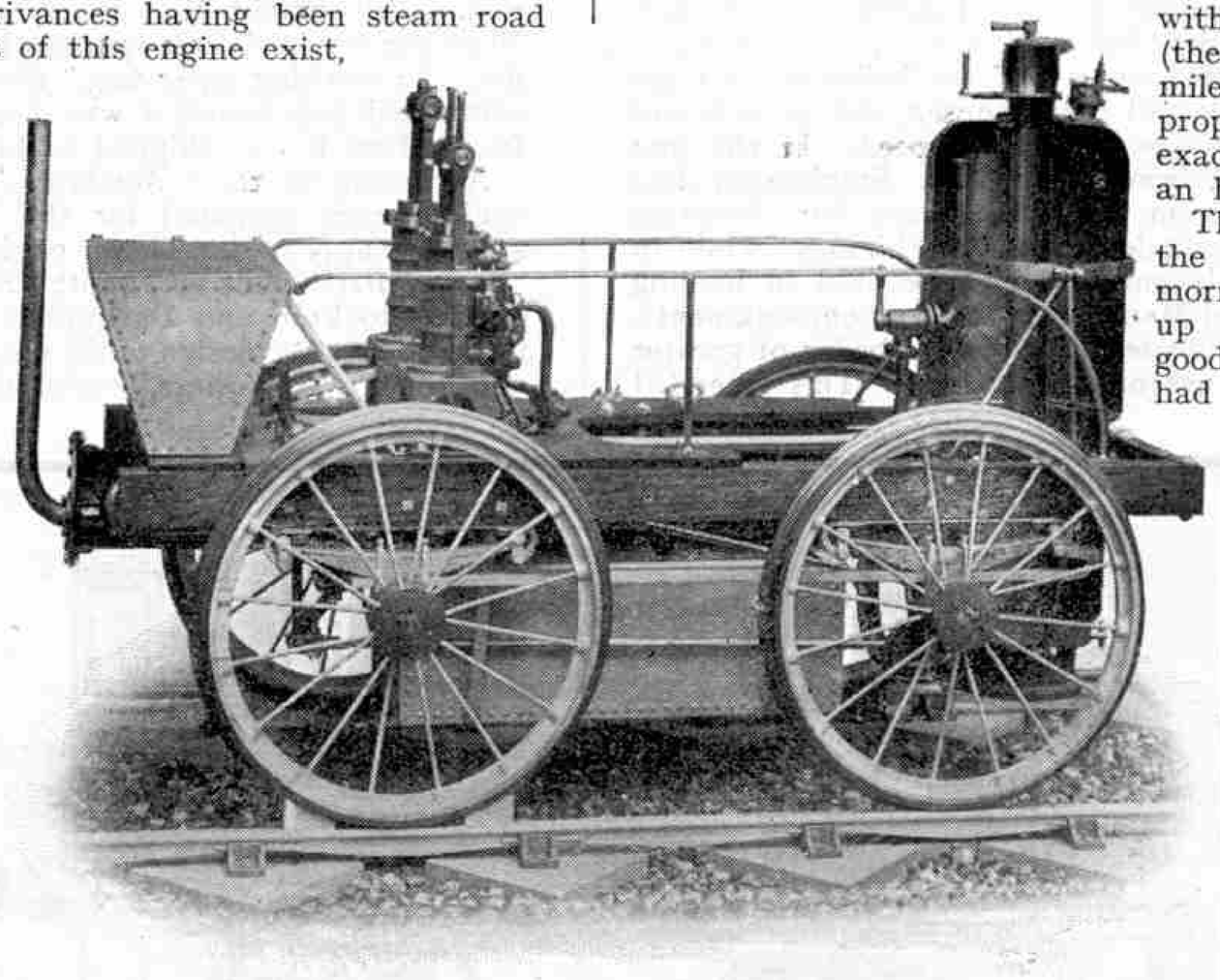
The "*Perseverance*" was Burstall's first attempt to build a steam locomotive, his previous contrivances having been steam road coaches. Very few particulars of this engine exist, but it is said to have weighed only 2 tons 17 cwt. An old drawing discovered recently depicts the engine as having four equal uncoupled wheels, and it is thought likely that these were driven from one or more vertical cylinders by way of "return connecting rods" which in turn worked a counter-shaft, the motion of which was transferred to the axle by means of gear wheels.

The trials were to be held on a level stretch of railroad about 1¾ miles in length at Rainhill, a village a few miles east of Liverpool ; and as the time drew near, engineers, scientists and mechanics from all parts of the country arrived to witness the event. The three judges appointed for the trials were Nicholas Wood, chief engineer at the Killingworth Collieries, who had had many years of locomotive experience ; John Urpeth Rastrick, a partner in a Stourbridge steam engine factory where locomotives were then being built ; and John Kennedy, of Manchester, an inventor of improvements in cotton spinning machinery.

Each competing engine was required to accomplish 20 journeys over the reserved length of track, at the prescribed speed of 10 miles an hour. Of the 1¾ miles of line, one-eighth of a mile was allowed at each end for starting and stopping. There was much public speculation as to which of the four locomotives would be the victor, and the "*Novelty*" is said to have been the general favourite. The "*Rocket*" does not seem to have compared favourably in appearance with its competitors, for neither the judges nor the spectators expected it to win the trials. It was quite characteristic of the Stephensons, however, that although their engine did not stand first in the list for trial, it was the first to get up steam, and it was then ordered out by the judges for an experimental trip. This proved quite successful, and the "*Rocket*" accomplished a non-stop run of 12 miles in approximately 53 minutes.

The "*Novelty*" was then called out, but owing to the afternoon being well advanced, and to differences of opinion having arisen as to the load that this engine should carry, a practical test was not made, the engine merely travelling the appointed length of track fo r exhibition purposes. The "*Sans Pareil*" was then similarly paraded.

Brandreth's horse machine also gave an exhibition. According to the "*Liverpool Courier*" of the following day "about fifty persons clung round the wagons, giving a gross weight with the machine of about five tons, and with this weight, the horses (themselves moving scarcely one mile and a quarter an hour) propelled the wagons and load exactly at the rate of five miles an hour."

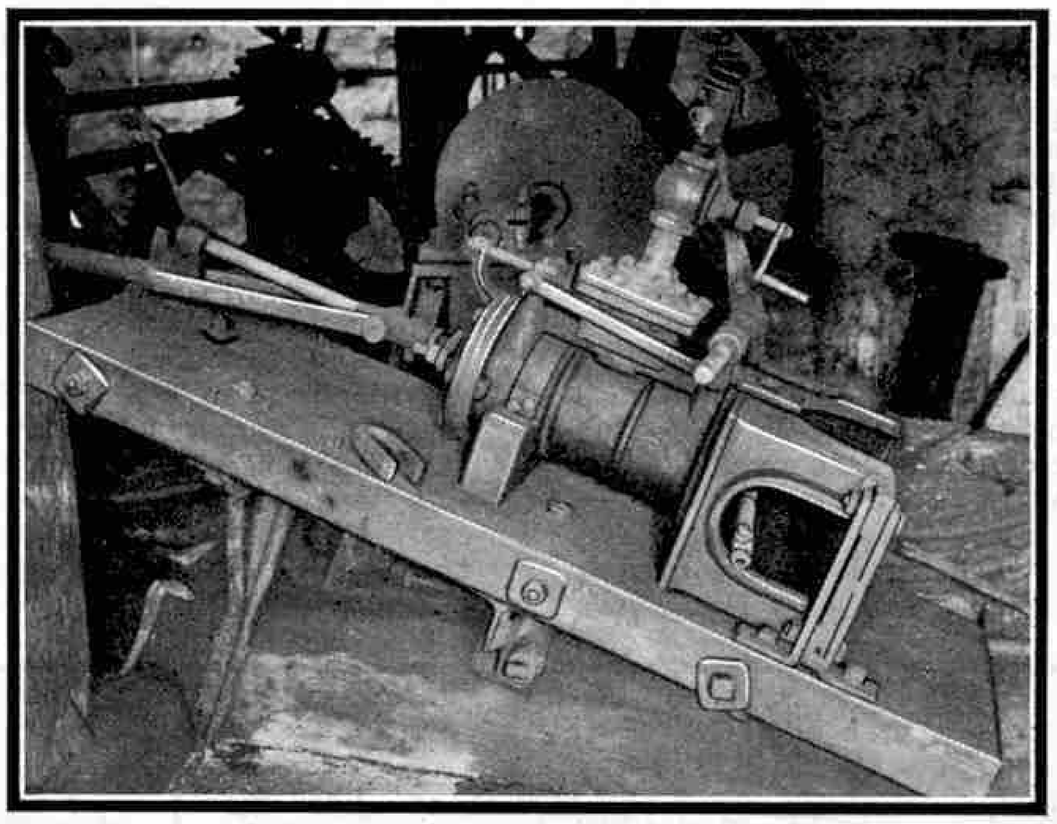


Braithwaite and Ericson's "*Novelty*," an unsuccessful competitor at the Rainhill Trials.

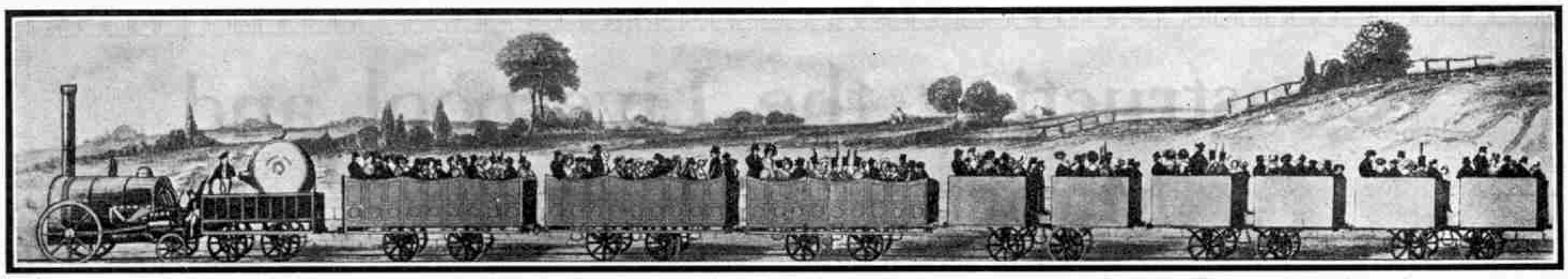
The promising exhibition feats of some of the locomotives caused the promoters of the trials to make the conditions of the competition more definite. On the morning of the third day it was announced that in order to qualify for the prize engines must travel 70 miles practically without stops, at an average speed of not less than 10 miles an hour. The distance represented 20 double journeys over the test length of railroad. Whatever misgivings the amended rule may have aroused in some of the competitors, Stephenson was undismayed, for he felt confident that the "*Rocket*" would complete the prescribed run without mishap.

In accordance with the judges' request the "*Rocket*" was got ready early on the morning of the 8th. The firebox was filled with coke, the fire lighted, and in less than an hour steam was raised from cold to a pressure of 50 lb. per sq. in. The locomotive set off on its "long-distance" trip, hauling a train of wagons totalling 13 tons in weight.

When the "*Rocket*" was travelling at full speed it presented a spectacle that must have been almost terrifying to the spectators of 100 years ago, and certainly would create alarm in the mind of any present-day engineer called upon to drive it ! As seen from the front, the locomotive appeared to move with a strange shouldering action, which was very largely due to the high position of the cylinders. These must have been very disturbing to the driver, for as their pistons went backward



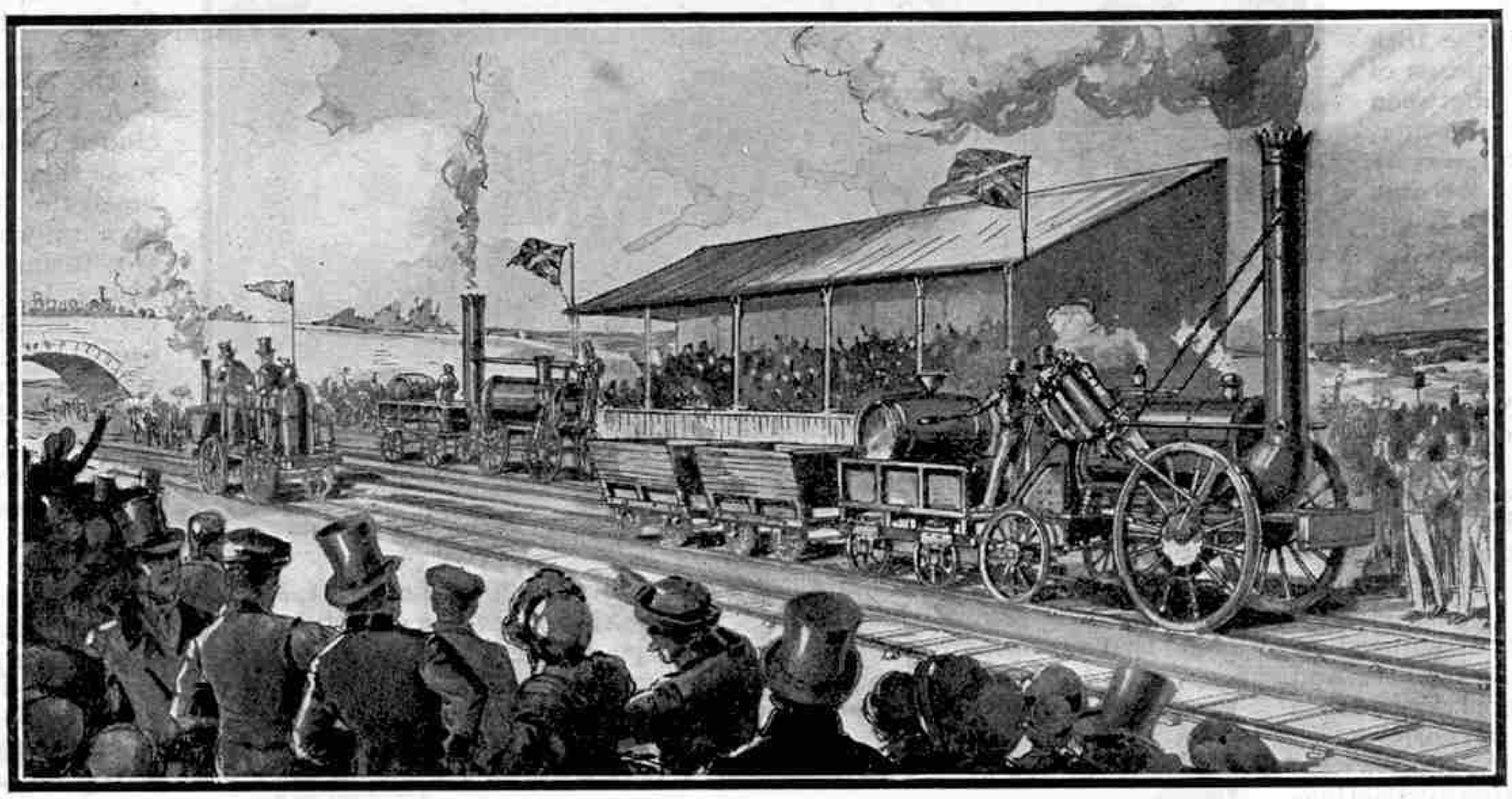
One of the original cylinders of the "*Novelty*," now used for driving a winch at the Rainhill Gas Company's works.



A train of second-class open carriages, hauled by the "*North Star*," illustrating the poor accommodation afforded to other than first-class passengers.

and forward the vibration threatened to tear out the bolts and stays that held them in position. To add to the discomfort of the driver, he was within a few inches of the vibrating cylinders, which to him would almost appear to be suspended in mid air. The only thing he could hold on to was the horizontal valve rod, and while standing uneasily on the narrow platform he had to manipulate far more complicated gearing than that controlled by the driver of a modern express locomotive, which in spite of its greater size and power may be handled with far more ease. This was not the end of the unfortunate driver's troubles, for owing to the absence of a cab he was fully exposed to the weather. Even when his face was frozen by the cold blast created by the passage of the locomotive at speeds up to 30 miles per hour, his feet would still be warm, for the back of the firebox appears to have consisted of nothing more than an iron plate that became red hot and threatened to scorch the man behind it

The "*Rocket*" accomplished the first 10 double journeys in 1 hr. 48 minutes, including stoppages, and the second 10 double trips in 2 hr. 3 minutes. The average speed for the whole of the journeys was 15 miles an hour, or 50 per cent. faster than required by the judges. At times the engine attained a speed of 20 miles an hour. The hourly consumption of fuel amounted to 217 lb. of coke and 114 gallons of water.



The scene at the locomotive trials at Rainhill, 1829.

The consistent performance of the "*Rocket*" greatly astonished the spectators, and when the locomotive arrived in front of the grandstand at the conclusion of its trip, one of the directors who had favoured the adoption of fixed engines, raised his hands and declared "Now has George Stephenson at last delivered himself!"

As repairs to the "*Novelty*" and the "*Sans Pareil*" were not completed, no trial runs were made on the following day. On the 10th, however, a notice was published that the "*Novelty*" would that day achieve more than other competing engines. The advertisement aroused great interest and when the engine duly appeared and set off on its trial run, hauling a load only about 7 tons in weight, its progress was eagerly followed by the throng of spectators. But misfortune again befell the engine, for before the first double journey was completed, it burst a pipe from the forcing pump. According to one account the pipe was repaired and the engine later made several trips running light, during which it attained a speed of from 24 to 28 miles an hour.

The repairs to the "*Sans Pareil*" were not finished until three days later, and it was then found to be 4 cwt. over the weight limit for four-wheeled engines. The judges allowed it to run, however, and with a load attached it attained a speed of about 14 miles an hour. During the eighth journey the water pump went wrong and the engine came to a standstill. The "*Sans Pareil*" was a glutton in respect to fuel and consumed no less than 692 lb. of coke and 150 gallons of water per hour. This was due to excessive sharpness of the steam blast in the chimney, which blew the burning coke into the air.

The judges were tiring of the repeated breakdowns, and at the close of the day's proceedings they announced that the morrow would be the last day of the trials. This news resulted in a great crowd of spectators being present on the 14th. Braithwaite and Ericsson begged to be allowed to "try out" the "*Novelty*," but although permission was granted they had no better luck, for the locomotive again broke down. A similar request for another chance was made by the owner of the "*Sans Pareil*," but the judges declined to grant it. They pointed out that the engine was heavier than the stipulated weight, and consumed an abnormal quantity of fuel.

The "*Perseverance*" made its first appearance at the trials on this day, but gave a very poor display, attaining a speed of barely six miles an hour. A fall during the unloading of this engine at Rainhill had broken a pipe and injured one of the cranks, and it seems probable that the engine's disappointing exhibition was due in part to its being repaired too hurriedly.

There was now only the "*Rocket*" left in the competition, and as it had more than complied with all the stipulated conditions, the Stephensons and Booth were accordingly awarded the prize of £500. As a final proof that the locomotive had been working well within its capacity, Stephenson proceeded to show that, freed of a load, it could travel at a speed of not less than 35 miles per hour!

The competition had a far wider importance than the triumph of the "*Rocket*" over its competitors; it established the efficiency of the locomotive for all future railways, and showed that a new power had arrived. The turning point of this vital matter may be said to have been Stephenson's combination of the steam blast and the multi-tubular boiler.

For many years the "*Rocket*" did good service on the Liverpool and Manchester Railway. Ultimately it was sold for £300, and for the next five or six years it hauled coal on a short line near Carlisle. There was still wonderful vitality in the old locomotive. On one occasion it ran a distance of more than four miles in 4½ minutes, thus reaching the remarkable speed of nearly 60 m.p.h. In 1844 it ceased to run, and for nearly 20 years it lay idle in a yard. In 1862 it was taken to the Science Museum, South Kensington, where it now stands on some of the original wrought iron rails of the Liverpool and Manchester line.

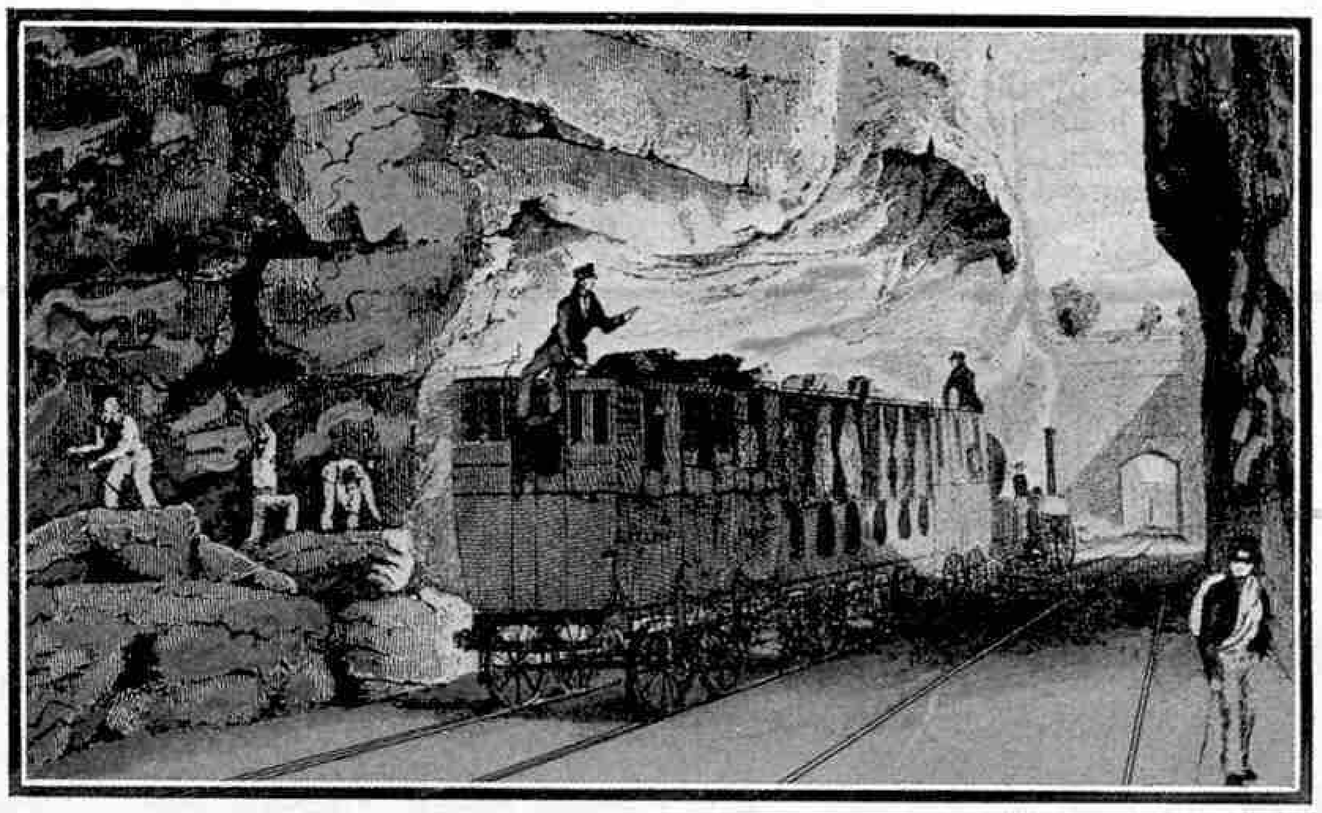
Of the other locomotives that competed at Rainhill the "*Novelty*" worked for some time on the Liverpool and Manchester Railway, and later did good work on the St. Helens and the North Union railways. The "*Sans Pareil*" was purchased by the directors of the Liverpool and Manchester Railway for £550 and let out on hire to the Bolton and Leigh Railway. This railway purchased it in 1832 for £110 and operated it until 1844, after which it was used for pumping at a colliery until 1853. It was then restored to its original form and presented to the Science (*Continued on page 687*)

Constructing the Liverpool and Manchester Railway

Stephenson Vanquishes Chat Moss

ONE hundred years ago this month was opened the Liverpool and Manchester Railway, now a part of the London Midland and Scottish system. This line has not the honour of being the first railway, but it provided the occasion for the first big railway battle in Parliament, and for the first large-scale development of railway engineering. It also brought about a unique contest at Rainhill that definitely proved the steam locomotive to be a practical source of power for rapid transport.

At the close of the 18th century the only means of communication between one town and another, other than by road was by canal. The canal became the chief means of commercial transport, and the canal companies found that they could obtain at their own price all the business they could cope with. In consequence they came to adopt a very independent attitude, feeling that their position was so secure that they could afford to ignore the demands of traders for better service and lower rates. The traders submitted to this state of affairs for a time, but eventually they began to resent it keenly and became ready to support any scheme that promised to provide improved transport facilities and to free them from dependence upon the canal authorities.

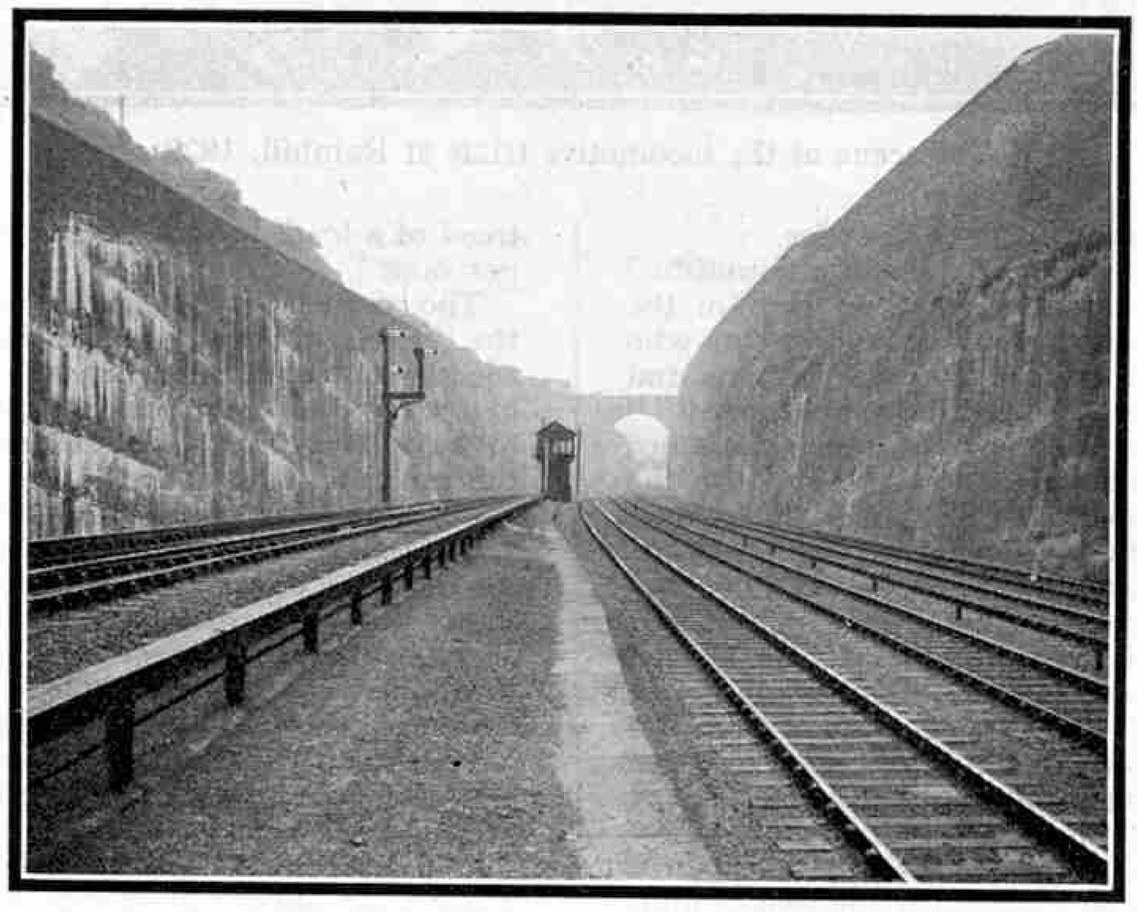


Olive Mount Cutting in 1831, showing early type of carriages with guard and luggage on the roof.

In Lancashire the traders were chafing under the restrictions of a monopoly formed by the Irwell and Mersey Navigation and the Duke of Bridgewater's Canal Company, and they cast about for alternative means of communication between Liverpool and Manchester. In 1797 William Jessop, who eight years previously had built an iron railway or wagonway at Loughborough in Leicestershire, put forward a scheme for a tramroad to be operated by horses. He went so far as to survey a route between the two towns, but this was not approved. A year later Benjamin Outram revived the idea and surveyed another route, but his efforts achieved nothing except to alarm the canal authorities slightly.

In 1821 Joseph Sanders, a Liverpool corn merchant, became acquainted with William James, a land agent and colliery owner, who had constructed short tramroads at some of his mines. James expressed the opinion that a tramroad would cope effectually with the growing traffic between Liverpool and Manchester, and Sanders was so impressed with the idea that he set to work to interest influential business people in the proposal. Among these men was Henry Booth, who later became Secretary of the Liverpool and Manchester Railway Company. James was commissioned to survey the route for a tramroad between the towns, but this proved imperfect; and a second one was then carried out with the assistance of Robert Stephenson. While these surveys were going on James visited Killingworth to see George Stephenson's engines in operation, and was so fascinated by them that he became a keen advocate of the locomotive.

A committee that included Sanders and Booth was then formed to investigate the possibility of a railway between the two towns. A deputation visited Darlington to view the unfinished line of the Stockton and Darlington Railway, and afterwards went to Newcastle and Sunderland, where they saw both fixed engines and locomotives at work. The deputation reported so favourably to the committee that on 20th May, 1824, it was decided "to form a Company of Proprietors for the establishment of a Double Railway between Liverpool and Manchester" This was the Liverpool and Manchester Railway Company, and its prospectus published in October of the same year created a great stir among canal proprietors and landowners. The prospectus declared that the canals were inadequate to carry out their work regularly and punctually at all times of the year, as they were subject to interference by drought in summer and by frosts in winter. It was pointed out also that the distance between Liverpool and Manchester by the Mersey and Irwell Navigation was more than 50 miles, whereas by railway the distance would be reduced to 33 miles; and that the railway would make it possible for passengers to travel between the two towns at half the existing cost. In reply the Leeds and Liverpool, the Grand Trunk, and other canal companies immediately published circulars appealing to canal and navigation companies throughout the country "to oppose the establishment of rail-roads wherever contemplated."



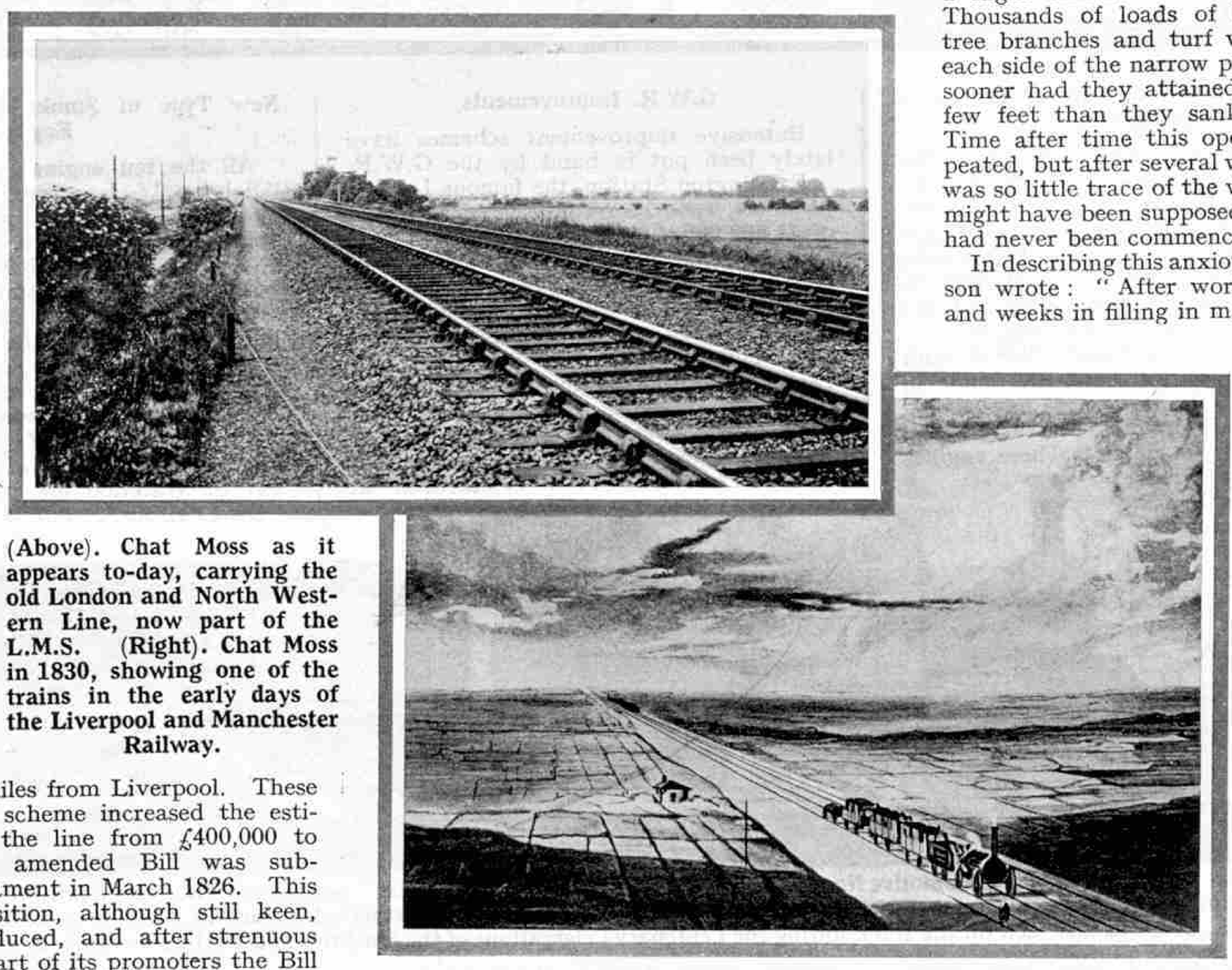
Olive Mount Cutting as it is to-day. The photographs illustrating this article are reproduced by courtesy of the L.M.S.R.

While the canal authorities were mobilising their resources to oppose the railway scheme, the great landowners were equally energetic in preparing to resist the passage of the line through

their estates. Every possible difficulty was placed in the way of the surveyors, and it needed a great deal of determination and a considerable amount of cunning to carry the work through to a successful conclusion.

The survey and the preliminary details of the scheme were completed in 1825 and submitted to Parliament, and then began a memorable struggle. The opposition now included not only the canal companies and the landowners, but also stage coach owners and others who believed that the railway would be harmful to them. The case for the railway company was put forward with great skill and was well backed up by George Stephenson; but the opposition was too strong and the Bill was defeated.

The railway company were not dismayed by this reverse and determined to renew their application during the next Parliamentary session. In the meantime it was decided to thoroughly review their position and to make a new survey for the line. This time the route selected avoided the estates of the landowners who had been most aggressively opposed to the railway, but it involved the boring of two deeply-graded tunnels to avoid crossing certain Liverpool streets, and also the excavation of a deep cutting a few miles from Liverpool. These changes in the scheme increased the estimated cost of the line from £400,000 to £510,000. The amended Bill was submitted to Parliament in March 1826. This time the opposition, although still keen, was greatly reduced, and after strenuous efforts on the part of its promoters the Bill was passed. The cost of obtaining Parliamentary sanction to the line amounted altogether to £27,000, or about £850 per mile of line.



(Above). Chat Moss as it appears to-day, carrying the old London and North Western Line, now part of the L.M.S. (Right). Chat Moss in 1830, showing one of the trains in the early days of the Liverpool and Manchester Railway.

George Stephenson was now appointed chief engineer of the Liverpool and Manchester Railway Company at a salary of £1,000 a year. He removed to Liverpool in order to superintend the work, and was followed by three of his pupils who were appointed as resident engineers for various parts of the line. Operations were commenced on 29th May, 1826.

One of the most formidable features of the project was that the railway had to cross Chat Moss, a great bog some twelve square miles in extent between Liverpool and Manchester. The bottom of the bog consisted of sand and clay, above which was a mass of decayed vegetation varying in depth from 10 ft. to 35 ft. During wet weather the bog absorbed the rain as easily as a huge sponge, and stood several feet higher at the centre than at the edges; during summer this water evaporated, leaving the bog saucer-shaped. It was impossible at any time for a man to walk across the Moss.

When the Bill had been before Parliament scathing remarks had been made in regard to Stephenson's proposal to cross Chat Moss. "Who but Stephenson would have thought of entering into it?" declared the opposing counsel. "It is ignorance inconceivable. It is perfect madness to propose such a plan." An eminent engineer, called as an expert witness by the opposition, declared that the only manner in which a railway could be carried across the marsh without sinking to the bottom was by laying it upon a solid embankment built up from the bed of the marsh. The cost of this embankment he estimated would be £270,000!

Stephenson was not in the least disturbed by these pessimistic opinions. He argued that just as snow-shoes distribute a man's weight over an area much greater than that occupied by his feet, so too would a platform bear a railway track above the bog. He did not intend to build an embankment such as had been recommended, but to make the railway float on the surface of the bog. This he proposed to accomplish by constructing a track of cross-sleepers supported by a matting of heather and branches, so that the track would really be an elongated raft.

The first step was to form a workmen's footpath of heather across the bog, and this path was then strengthened sufficiently to carry a narrow gauge track for the transport of materials necessary for constructing the permanent way. It was found impossible to lay a drain in the centre of the bog, and Stephenson therefore provided a course for the water by laying a line of empty tar barrels and covering it with clay. The greatest difficulty was experienced at the Manchester end, where a slight embankment had to be built. Thousands of loads of heather, grass, tree branches and turf were spread on each side of the narrow pathway, but no sooner had they attained a height of a few feet than they sank out of sight. Time after time this operation was repeated, but after several weeks' toil there was so little trace of the workings that it might have been supposed that the work had never been commenced.

In describing this anxious time Stephenson wrote: "After working for weeks and weeks in filling in materials to form the road, there did not yet appear to be the least sign of our being able to raise the solid embankment one single inch; in other words, we went on filling in without the slightest apparent effect. Even my assistants began to feel uneasy and to doubt the success of the scheme. The directors spoke of it as a hopeless task and at length they became seriously alarmed—so much so indeed that a Board meeting was held on Chat Moss to decide whether we should proceed any farther. There was no help for it, however, but to go on, as an enormous outlay had been incurred and great loss would have been occasioned had the scheme been abandoned and the line taken by another route. So the directors were compelled to go on with my plans—of the ultimate success of which I myself never for one moment doubted."

As Stephenson had never tackled a job of this kind before, his absolute confidence in himself is surprising. He was never in the least discouraged, even though men who had lived in the district all their lives prophesied that his plan was bound to fail. "If you knew as much about Chat Moss as we do," they said, "you would never have entered on so rash an undertaking." Stephenson went on steadily with the work, and at length his confidence was rewarded. The material that had disappeared from sight day after day with such disheartening persistence had sunk slowly through the bog to the solid bottom and had then begun to rise. Thus, although nothing was to be seen from the surface, a bank had grown steadily. Ultimately it reached the surface and emerged from it. Soon this bank was joined to the floating road already laid across the Moss from the Liverpool side, and the "impossible" was accomplished. The line across the Moss cost only £28,000, and so far from being the most costly portion of the railway, was almost the cheapest.

We have referred previously to the tunnelling and excavation at Liverpool made necessary by the change of route adopted for the line. At Olive Mount, then outside Liverpool, the land rises to a height of 169 ft. above sea level in the form of a ridge of sandstone; and through this great mass of rock

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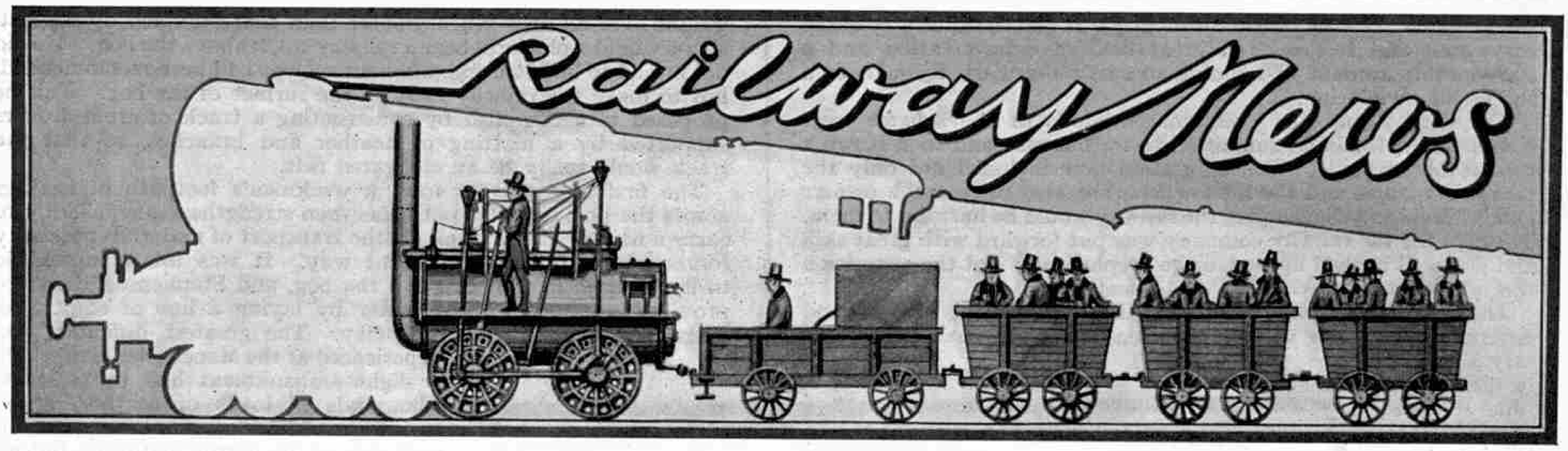


G.W.R. Locomotives at Railway Centenary Celebrations

The last of the new "Kings"—No. 6029, *"King Stephen"*—is being sent to represent the G.W.R. at the Centenary Celebrations of the Liverpool and Manchester Railway, which are being held this month at Liverpool. It will be accompanied by the replica of the old broad-gauge engine *"North Star."*

The new batch of twenty 2–8–0 tank engines, to which reference was made in last month's *"M.M.,"* are now being turned out at Swindon. The first to be completed was No. 5275. These engines are fitted with sliding doors on the cab sides similar to those already fitted to several engines of the "4500" and "5500" series. These doors afford a welcome protection to the enginemen during cold and rough weather.

Further engines of the 0–6–0T type have been received from outside firms as follows:—Nos. 6712-14, from W. G. Bagnall Ltd.; Nos. 7719-23, from Kerr Stuart Ltd.; and No. 6734 from The Yorkshire Engine Co. Ltd.

Engine No. 4060, *"Princess Eugenie"* has recently been to Swindon for repairs, and has been fitted with new steam pipes to the outside cylinders. These are of the same novel type as were fitted previously to No. 4002, *"Evening Star."* The steam admission to the cylinders remains, as formerly, from inside the frames, but elbows like those on the "Castle" class have been fitted on the sides of the smoke-box and from them, pipes pass around and down inside the frames to the points of admission.

More Wagons for the L.N.E.R.

The L.N.E.R. announce that 2,025 additional wagons are to be built during 1930. Of these 1,940 will be 12-ton covered wagons, 35 are to be 8-ton ventilated refrigerator vans and 50 are 20-ton brake vans. The whole of the vehicles will be constructed in the L.N.E.R. Works.

Also included in the programme are 25 wagons of 50 tons capacity each for the conveyance of bricks, and 125 locomotive coal wagons, each to carry 20 tons.

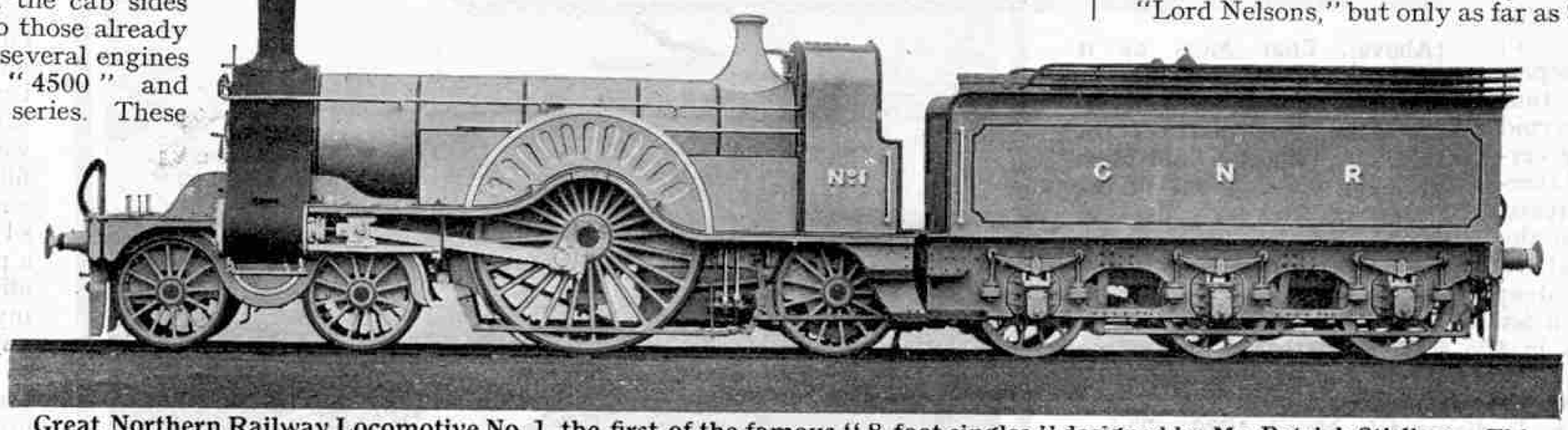
G.W.R. Improvements

Extensive improvement schemes have lately been put in hand by the G.W.R.

Paddington Station, the famous London terminus, is to be reconstructed at a cost of £1,000,000. Work has already begun and by 1932 the present station will be used by purely long-distance trains. Suburban traffic will be diverted to a rebuilt station at Bishops Road at the lower end of Paddington Station. The twelve platforms of the existing station are to be extended to a length of from 1,000 to 1,400 feet, and glass roofing is to be carried over the whole station.

Work has also been commenced at Bristol, where Temple Meads Station is to be completely transformed. The new station will occupy an area nearly three times that of the present station, and when completed will be one of the finest in the country. The scheme includes the quadrupling of the lines between South Wales Junction and Portishead Junction, and this, together with the new layout at Temple Meads, will greatly facilitate the working through Bristol of trains to and from all parts of the country, and will ease considerably the congestion at present experienced. The cost of this scheme is about £1,250,000.

The G.W.R. are also planning to spend £3,000,000 on improvements at their South Wales ports.



Great Northern Railway Locomotive No. 1, the first of the famous "8-foot singles" designed by Mr. Patrick Stirling. This engine was built in 1870, and was withdrawn from service in 1907. It is now preserved in the L.N.E. Railway Museum at York, and was last seen on the track during the Centenary Celebrations of the Stockton and Darlington Railway in 1925.

The Somerset and Dorset Railway

By an agreement made recently, the Somerset and Dorset Railway has ceased to be worked as a separate concern. There is still a joint committee on which the L.M.S. and Southern Railways have three directors each, but the operation of the line, which formerly was carried on by a separate staff, is now taken over by the L.M.S., together with the locomotives and rolling stock, while the Southern Railway are responsible for the maintenance of the track and other works.

New Type of Smoke Deflector on S.R. Engine

All the ten engines of the new 4–4–0 "Schools" class are now in service and are stationed as follows:—Nos. 900-3 at Deal; Nos. 905-6 at Dover; and Nos. 904, 907-9 at Eastbourne. Although none are stationed in London all are working into London.

Five engines of the "Lord Nelson" class are now stationed at Nine Elms shed and are employed on the fast and heavy expresses between Waterloo and the West of England. The 10-40 a.m. *"Atlantic Coast Express"* and the 11-0 a.m. out of Waterloo are usually worked by "Lord Nelsons," but only as far as Salisbury and not through to Exeter, as was done last summer.

Engine No. 834, of the mixed traffic 4–6–0 type, has been fitted with a new type of smoke-deflector. The steel plates of the smoke-box sides are extended in front and shaped to deflect the rush of air downwards instead of upwards, as do those fitted to the "Lord Nelsons" and "King Arthurs."

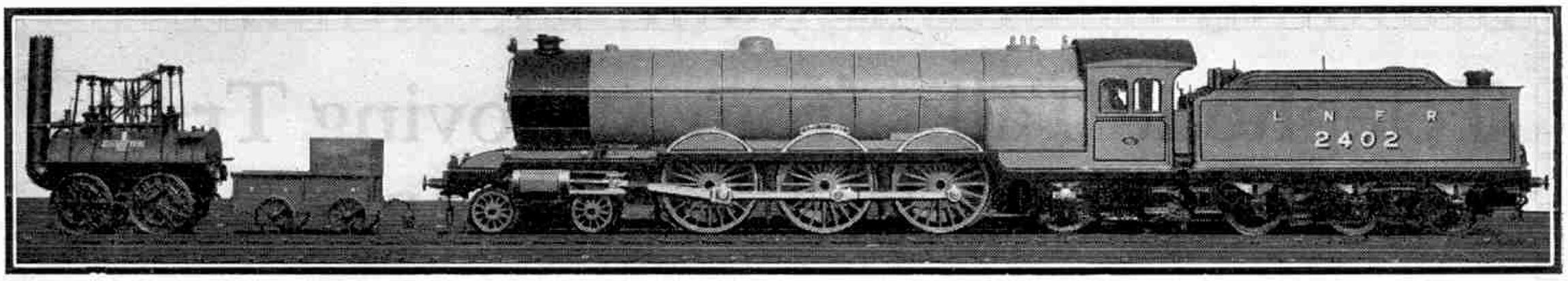
New G.W.R. Observation Saloons

The latest development in luxury travel is afforded by the G.W.R., who have just introduced first class saloons complete with lounge, dining saloon, rest compartment and kitchen.

The lounge of this "service flat on wheels," which is complete with easy chairs, settees, writing table, reading lamp and mirrors is situated at one end of the coach—the dining saloon, seating 14, at the other. Both are fitted with long side and end observation windows from which to view the passing scenery. Between these rooms are the rest compartment, kitchen and pantry, equipped on modern lines and capable of catering for passengers' requirements during the journey.

Walking that Others Might Ride

In order that others might travel in safety, Mr. W. Barker, a foreman platelayer of Earlsheaton, Yorkshire, who has just retired, has walked 110,000 miles during his 48 years' service with the L.N.E.R.



A century of locomotive progress. The Stockton and Darlington Railway's first engine "*Locomotion*," constructed by George Stephenson, preceding the L.N.E.R. "Pacific," No. 2402, "*City of York*," designed by Sir Vincent Raven. The weight of the former is 11 tons 5 cwt. The modern engine with tender weighs 148 tons 2 cwt. !

The Holiday Rush

The heaviest rush of traffic with which the British railway companies have to cope is that associated with the August holiday season. On the Friday and Saturday preceding the Bank Holiday almost every available passenger engine and coach has to be pressed into service. This volume of traffic is spread over nearly the whole of the country, but its fullest force is felt at the great London termini. All the important expresses have to be run in duplicate or triplicate, and sometimes, indeed, even more than three portions are required.

No railway caters more fully for holiday makers than does the Southern, and during the early days of August tremendous crowds had to be dealt with at Waterloo, Victoria, Charing Cross, London Bridge and the other big London stations on this line. For the Bank Holiday week-end more than 200 additional trains were necessary. Of these, 28 ran to Brighton, and no less than 52 extra trains were needed to convey the passengers travelling to the Continent and the Channel Isles.

On the G.W.R. also traffic was very heavy. Enormous crowds thronged the platforms at Paddington but accommodation was found for all and the trains were got away with remarkable punctuality. On Saturday, 2nd August, the "*10-30 Limited*," better known as the "*Cornish Riviera Express*," ran in three portions, but all were away by 10-32. The "*Channel Isles Boat Train*" and the "*Torbay Limited*" also ran in three parts. Engines of either the "King" or "Castle" class were provided for all the most important trains.

Many thousands of holiday makers for Scotland and all parts of the East coast were carried by the L.N.E.R. Liverpool Street—that busiest of stations—became greatly busier during the great holiday season, and nowhere was the rush to Scotland more in evidence than at King's Cross on the evening of Friday, 1st August. A long succession of trains left this famous gateway to the North, some of them drawn by mighty modern "Pacifics," others by older "Atlantics," and in one case two "Atlantics" headed a train. It was noteworthy that on that day, when traffic was so abnormally heavy, the non-stop "*Flying Scotsman*" in both directions arrived on time or before. "No. 10000" on the down "*Scotsman*" kept exact time, while one of the newest "Pacifics," No. 2795, "*Call Boy*," brought the up train in five minutes early.

On the L.M.S. the normal services were greatly augmented. Not only were many trains run in two or more parts, but in some cases the loads were increased beyond those fixed in the working time-tables. On 1st August, the "*Royal Scot*" ran in three portions—all drawn by engines of the "Royal Scot" class. "*The Welshman*," 11-10 a.m. from Euston, was made up to 17 coaches, and was drawn by a "Claughton" piloted by a "Precursor."

L.N.E.R. Locomotive News

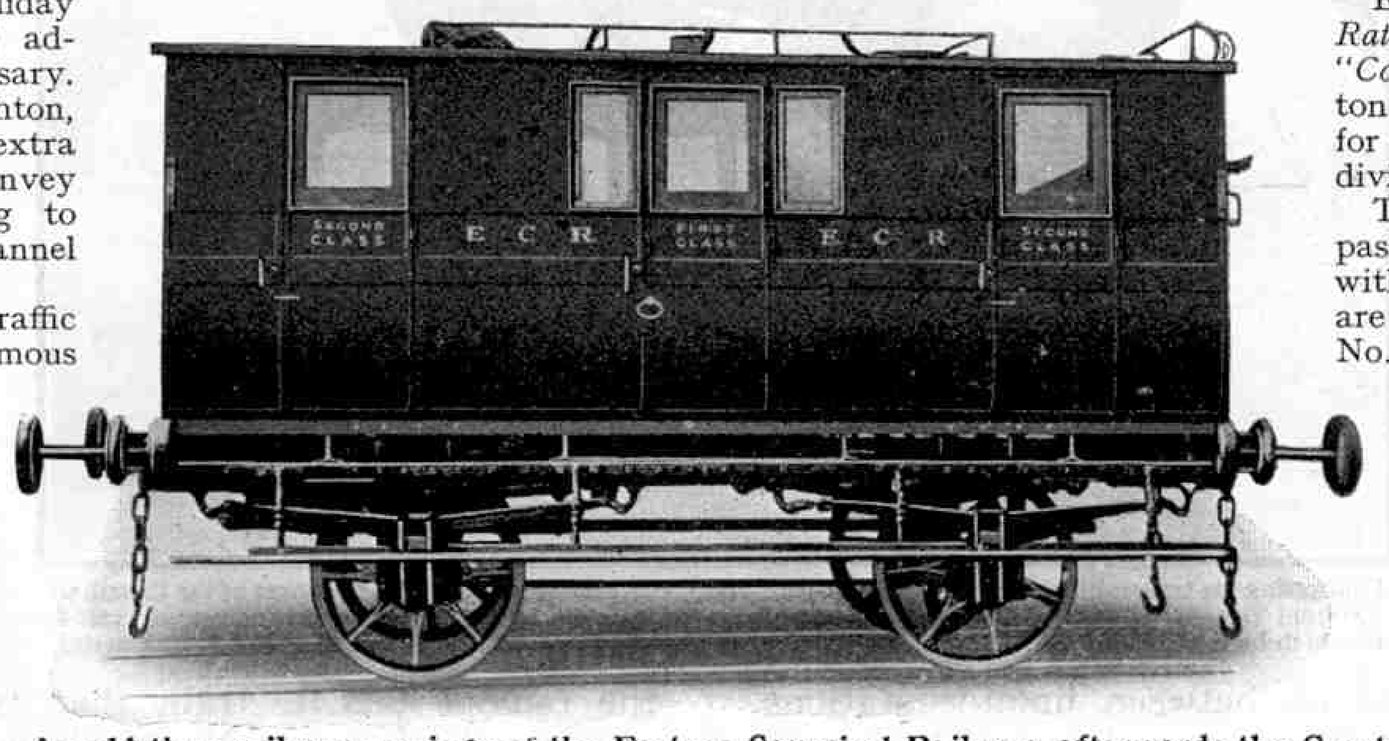
Three more 2–6–0 tender engines of the "K3" class have been completed at Darlington. They are numbered 2761-3.

Several of the new 200 h.p. Sentinel-Cammell rail-cars are now at work. No. 2279, "*Norfolk*," is stationed at Starbeck, while No. 2281, "*Old John Bull*" is at Guisborough where it has taken the place of a steam train on the service between Guisborough, Middlesbrough and Saltburn.

One of the two last "Pacifics" to be completed at Doncaster is to be named "*Blenheim*."

Since being put into regular service, the special high-pressure engine, "No. 10000," has done some excellent running. On Thursday, 31st July, it brought the "*Flying Scotsman*" from Edinburgh to London, and then left King's Cross again next morning with the corresponding northbound train. In each direction the run of 393 miles was made non-stop and scheduled time was kept.

On another day, when working the fastest train on the L.N.E.R.,—the 9-01 p.m. from Darlington to York—"No. 10000" improved on the tight time-table allowance by a minute and covered the 44.1 miles in exactly 42 minutes, start to stop.



An old-time railway carriage of the Eastern Counties' Railway, afterwards the Great Eastern Railway. The second class compartments have windows in the doors only and luggage was carried on the roof.

Veteran L.M.S. Locomotives Retired

The latest 2–6–0 mixed-traffic engines that have been turned out from Crewe are numbered 13185-9. Of the last 20 engines built of this class, some have been allocated to each of the Central, Midland, Northern and Western divisions. This handy type of engine is well fitted to tackle almost any class of train on nearly every part of the line.

Twenty more 0–8–0 standard freight engines are to be put in hand at Crewe when the 2–6–0's now building have been completed. They will be numbered from 9600 to 9619.

The "Royal Scot" engine No. 6123, "*Royal Irish Fusilier*," has been adorned with two plaques, bearing the crest of the regiment after which it is named. They were presented by Lieutenant-General T. E. Scott.

Engines No. 5905, "*Lord Rathmore*," and No. 5940, "*Columbus*," of the "Claughton" class, have been adapted for working over the Northern division.

Three more "Jumbos," 2–4–0 passenger engines, have been withdrawn from service. They are: No. 5042, "*The Auditor*," No. 5054, "*Antelope*," and No. 5068, "*Miranda*." Engines No. 5139, "*Magnificent*," and No. 5176, "*Agincourt*," of the 4–4–0 "Renown" class, have also been withdrawn.

Locomotive Equipped with Roller Bearings

An experimental locomotive, combining many unusual features, has been built to the order of an American company whose business it is to manufacture roller bearings. The chief aim is to demonstrate the value of such bearings as applied to steam locomotives, but, in addition, the engine has been fitted with many of the most modern devices including a booster, mechanical stokers, feed-water heaters, tube-cleaners, steam dryers, and automatic speed-control mechanism.

The locomotive is of the 4–8–4 type, with 6 ft. 1 in. driving wheels, and cylinders 27 in. by 30 in. The boiler has 7,257 sq. ft. of heating surface; its working pressure is 250 lbs., and the grate area amounts to 88 sq. ft. The tender, which is mounted on two six-wheeled bogies, has a capacity of 14,200 gallons of water and 20 tons of coal. It weighs 145 tons. The engine itself weighs 205 tons, thus making a total of 350 tons.

The locomotive has proved itself capable of attaining a speed of 85 m.p.h.

Telephone Talks from a Moving Train

Miniature Broadcasting Station on C.N.R. Express

NOT many years ago a passenger in a train was completely cut off from the outer world practically the whole of his journey, and only on arrival in stations could he receive telegrams, or get into touch with friends or business associates. Many efforts have been made to devise satisfactory means of communication under these circumstances. Necessarily these were electrical in character and depended on inductive effects between coils of wire on the train and the lineside telegraph wires. For instance, Edison devised a system of telegraphy for this purpose that was comparatively successful, but it was not until the advent of wireless that any real enthusiasm was shown, and only within the last year or so has any effort been made to place a real telephone service at the disposal of the occupants of a moving train.

As long ago as 1902 Sir Ernest Rutherford, F.R.S., then Professor of Physics in McGill University, Toronto, aided by Professor H. T. Barnes, showed that wireless telegraphy could be carried on between lineside stations and trains travelling at 60 miles an hour. Their tests were made on trains running on the main line near Montreal. Since that time, wireless has made rapid strides, and for the past six years a regular service has been given to passengers on the Canadian National Railways. To-day programmes broadcast in Canada and the United States are received on 24 of the principal trains of that Company.

The next step toward enabling ordinary telephone communication to be carried on was taken in Germany, where messages passed in only one direction at a time. But it was in Canada that full communication was first established and the inauguration of the earliest complete two-way telephone service to and from a moving train took place on Sunday, 27th April, 1930. Then Sir Henry Thornton, President of the Canadian National Railways, held a telephone conversation with an official of the same Company who was seated at his desk in his office in London, this proceeding as calmly and easily as if the two were speaking from different sections of the same town.

The successful demonstration of the first telephone conversation was the culmination of two years of experiment by the telegraph engineers of the C.N.R. The system that they have developed enables a traveller on a train fitted with the necessary apparatus to keep in communication by telephone with people in any part of North America. All that is necessary is that the exchange number and city required should be given to the wireless telephone operator on the train, and the call is put through with no more delay than usually is the case in making regular long distance calls.

Calling up a passenger on the train is equally easy. Anyone who wishes to do this merely asks to be put into long distance communication with the train, and names the person to whom he wishes to speak. Immediately the call is received by the operator on the train, the person wanted is called to the telephone and the conversation proceeds in spite of the fact that he is travelling at great speed.

Connecting the transmitting aerial to the lead-in. Mr. J. C. Burkholder, the Chief Engineer of the Canadian National Telegraphs, putting the finishing touches to the wireless telephone apparatus for use on trains, of which he is the designer. On each side of the car are two wires that form part of the receiving aerial.

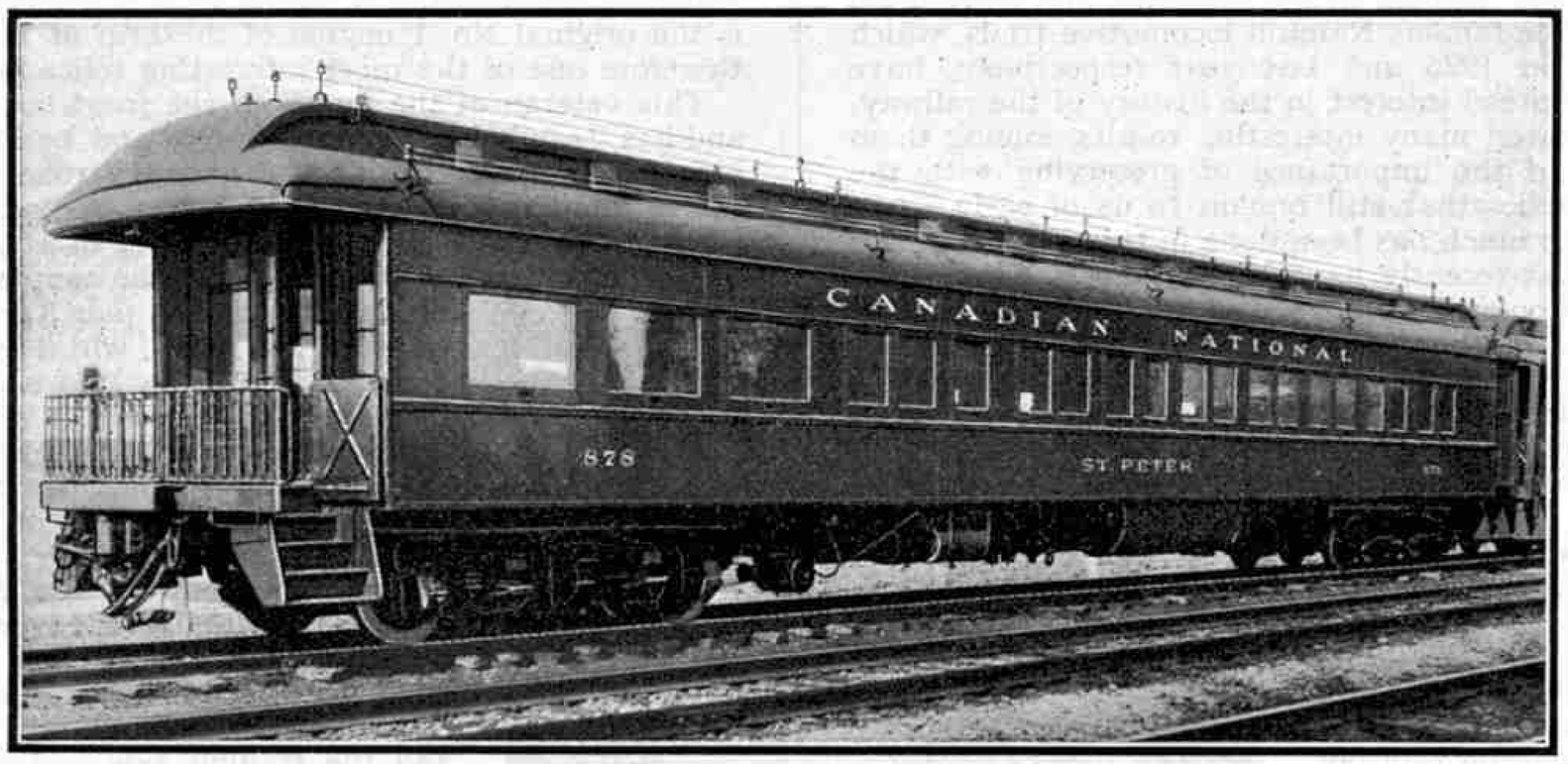
At present the train wireless telephone is only in operation on the *"International Limited."* This is the famous C.N.R. train that traverses the distance of 848 miles between Montreal and Chicago in 18 hours 15 min., and by covering the 334 miles between the former city and Toronto in 360 minutes establishes what is claimed to be a world's speed record for runs of equal or similar length. Readers will remember that this express was dealt with by Mr. Allen in an article in his series on *"Famous Trains"* that appeared on page 8 of the *"M.M."* for January, 1929.

In order to make telephone communication of this kind possible, what may be described as a miniature broadcasting station has been established on the train itself. The transmitting aerial is installed above the roof of the car in which this is carried, and a pair of the wires that run parallel to the track act as receiving aerials for the waves transmitted. The currents produced in these are picked up at one of two points on the line. The first of these is at Cobourg, Ontario, 70 miles from Toronto, and the second at Morrisburg, which is 171 miles further east. From these places the currents conveying the messages are transferred after amplification to the usual long distance lines of Canada and the United States.

For telephoning in the reverse direction, a second

pair of lineside wires act as transmitting aerials and the wireless waves radiated from them excite currents in the wires of a receiving aerial erected on top of the car in which the broadcasting station on the train is established. From this they pass into the receiving apparatus and are amplified before reaching the telephone.

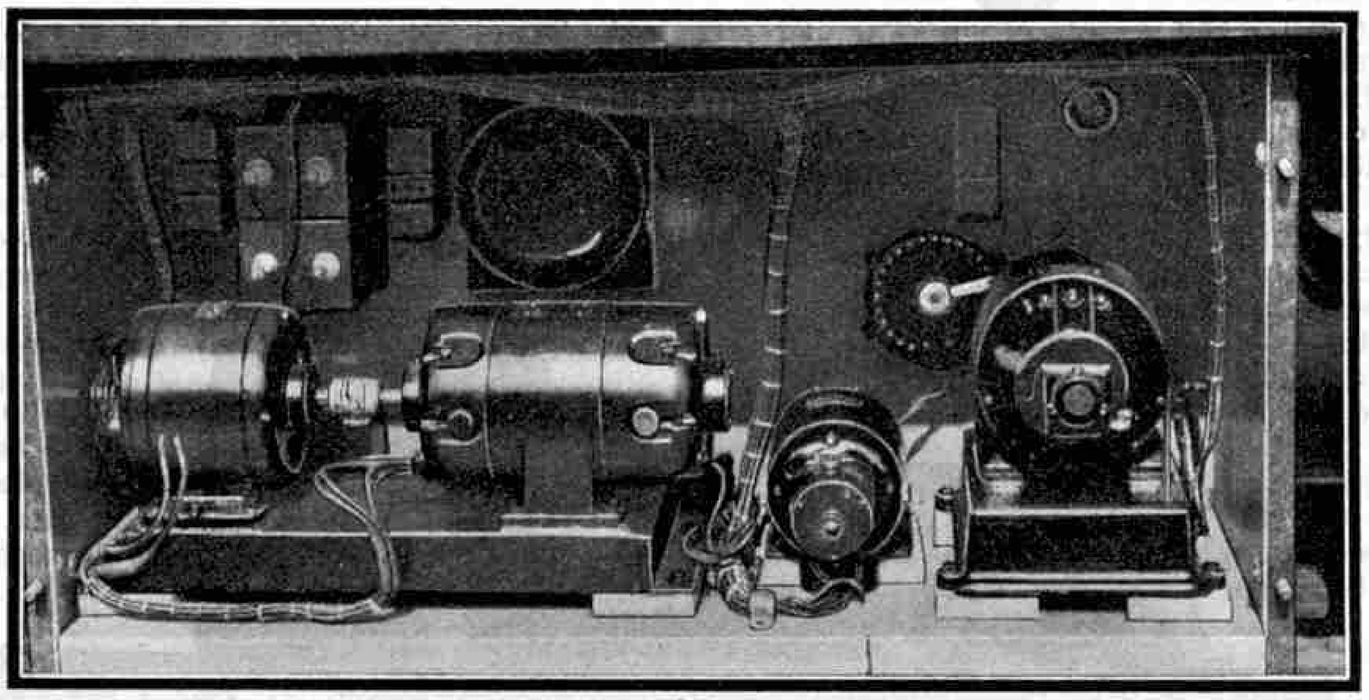
The aerial installation on top of the car consists of seven strands of No. 9 A.W.G. copper wire, the three in the centre being used for transmitting and two on each side for receiving. They are strung on insulators about twelve inches above the roof of the car, and are coupled to the transmitting and receiving apparatus by means of variometers that provide very sharp tuning. The sets are earthed by short connections to the steel trucks of the car.



The Canadian National Railways car "St. Peter," afterwards re-named "Minaki," equipped for the new system. For this and the other illustrations to this article we are indebted to the courtesy of the Canadian National Railways.

The employment of lineside wires as aerials does not interfere with their use for other purposes and there is no confusion. Another interesting point is that the telephone conversations from the train are practically secret. The frequencies used in train telephony on the Canadian National Railway are much lower than those employed in ordinary broadcasting, and even if they were picked up by a receiving set tuned to their special frequency, the result would be unintelligible unless special circuits were employed. In addition the signals can only be received at short distances from the lineside.

The problem of designing apparatus to work efficiently under the novel conditions of train telephony was by no means easy to solve. One great difficulty arose from the nearness of the two sets of wires, the aerial of the receiver being well placed for taking in the signals radiated from that of the transmitter! This difficulty was further complicated by the fact that the output power of the transmitter is roughly two hundred million times as great as that taken in by the receiver. In order to separate speech transmitted from that received, therefore, complicated and carefully designed filters are employed. If this were not done, the slightest coupling between the output of the receiver and the input of the transmitter would be sufficient to start the whole circuit into violent oscillation.



The motor generator equipment used to supply electric energy for the operation of the wireless telephone system introduced by the Canadian National Railways. The equipment is housed in a box underneath the coach containing the wireless outfit.

The electric energy required for the operation of the apparatus in the car is supplied by a motor generator equipment mounted beneath the coach. Actually three generators are employed. One of these maintains a potential of 150 volts on the anodes, or plates, of the various valves. A smaller one provides the necessary current for the signalling and telephone equipment, and a third one generates current for the purpose of operating the wireless apparatus itself. Filtering equipment also is provided in order to eliminate generator hum.

The installation of the wireless telephone in the *"International Limited"* is only the beginning of its usefulness, for there is no doubt of the practicability of the system. Improvements will be made in its operation, and as its advantages become better known greater use will be made of it.

During the trials of the train on which the apparatus was installed, calls were made by various persons on the train to friends in several cities in Canada and in the United States. No difficulty was experienced in making the necessary connections or in carrying on conversation. In fact, so well did the new apparatus perform its duties that an address given on the train was carried to CNRT, the Canadian National Railway's wireless transmitting station in Toronto. From there it was broadcast, and listeners in the vicinity were greatly astonished on learning that the address they heard was being given on a train travelling at 60 m.p.h.

The designer of the equipment is Mr. J. C. Burkholder, Chief Engineer of the Canadian National Railways telephones and telegraphs. Mr. Burkholder is only 31 years of age and is practically self-educated, for he has had no college training. He joined the American Telephone and Telegraph Company in 1915, his only knowledge of electricity at the time being that gained while acting as an electrician's helper, and he has made many valuable inventions in connection with telegraphy and the transmission of photographs over land wires.

A Locomotive Built 92 Years Ago

The "*Lion's*" Wonderful Career

THE centenaries of the opening of the Stockton and Darlington Railway and of the famous Rainhill locomotive trials, which were celebrated in 1925 and last year respectively, have aroused new and widespread interest in the history of the railway. This interest has produced many interesting results, among them being the realisation of the importance of preserving with the utmost care the few relics that still remain to us of early railway days, and of late much has been done in this respect.

Among the relics that recently have been taken in hand for preservation an honoured place must be assigned to the old locomotive "*Lion*," which was built 92 years ago by the firm of Todd, Kitson & Laird to the order of the Liverpool and Manchester Railway. Notwithstanding the crudeness of her design and structure, this veteran only ceased active work in 1928 at the conclusion of a period of 70 years' work in driving the chain pumps at the Prince's Graving Dock, Liverpool. Previous to this the "*Lion*" had successfully completed over 20 years of strenuous work with the Liverpool and Manchester Railway and its successor, the London and North Western Railway.

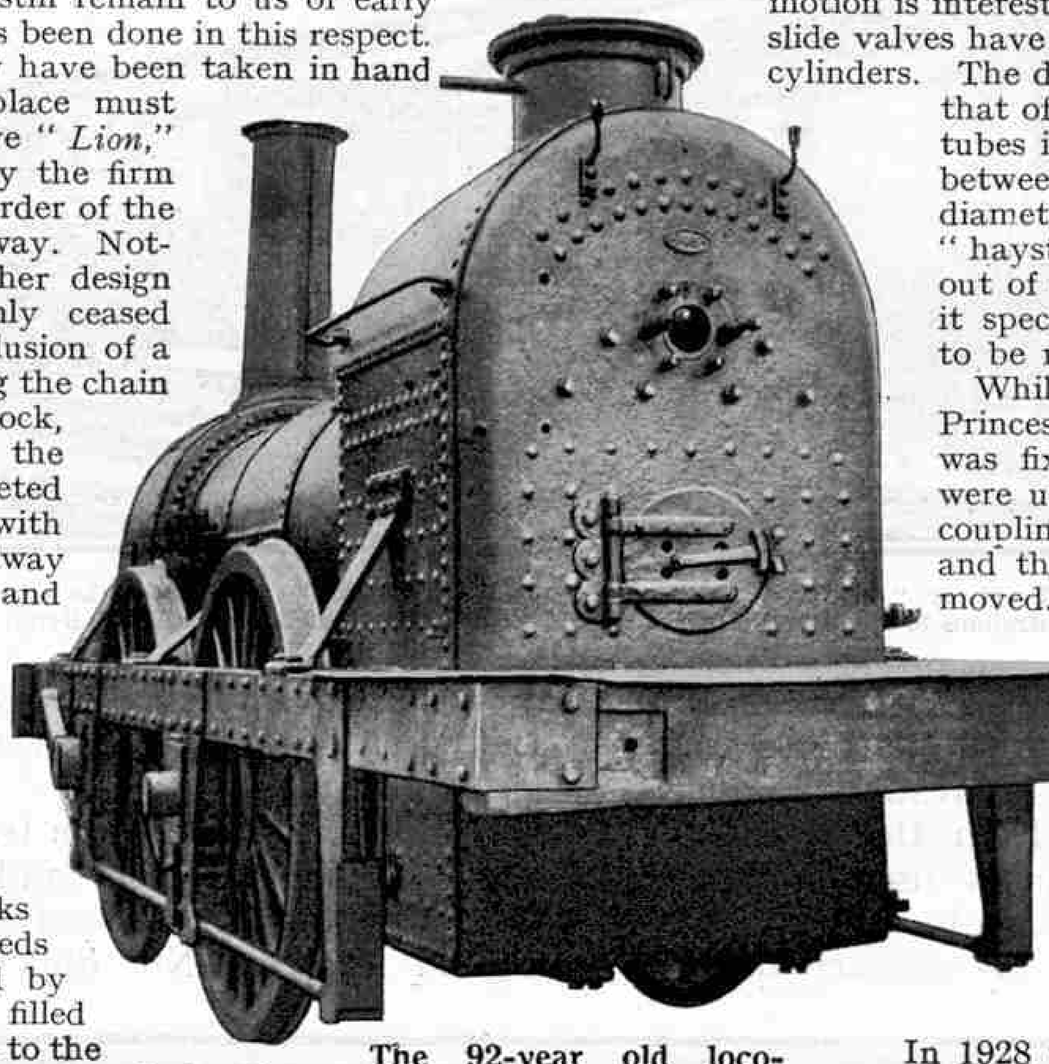
The story of this locomotive is extremely interesting, and to tell it properly it is necessary to go back to the days when the steam locomotive in its crudest form was just beginning to make its appearance.

In those days the empty trucks of the Middleton coal mine at Leeds were hauled up to the pit-head by means of horses and were then filled with coal and allowed to run down to the staithes. For years this arrangement worked satisfactorily and no better scheme seemed likely to develop. Presently, however, rumours began to arrive of wonderful results achieved by an iron monster propelled by steam. This new-fangled notion met with ridicule and bitter opposition, but the facts were there, and presently people who were interested in haulage problems began to realise that here was something they could not ignore. This was the case with the owners of the Middleton colliery. They investigated the matter thoroughly, and having satisfied themselves with the possibilities of the steam locomotive they introduced it as a substitute for horse-power. This change took place in 1812, and the locomotive used was built by Matthew Murray, who was assisted in his work by a man named Blenkinsop. Murray s efforts were successful and he may be regarded as the man who built the first commercially-successful locomotive.

About this time a Leeds youth named James Kitson was enthusiastically devoting himself to the study of music. In 1815 he became a choir boy in the parish church of Leeds, and his enthusiasm was so great that he set to work to build an organ in an outhouse belonging to his father. The erection of this organ brought him into contact with various mechanics, and eventually he became so interested in engineering matters generally that he entered into partnership with a man named Todd. This man Todd is supposed to have studied under Matthew Murray, and if this is so it is probable that the "*Lion*" is the original No. 1 engine of the firm of Todd and Kitson, and therefore one of the most interesting relics in locomotive history.

This veteran of the line is of the front coupled, or 0–4–2 type, and has "sandwich" outside frames and bearings. The cylinders are 11 in. diameter inside and have a stroke of 20 in. The valve motion is interesting as it is of the gab type, while the flat slide valves have a travel of 2½ in. and work on top of the cylinders. The diameter of the coupled wheels is 5 ft. and that of the trailing pair 3 ft. 7 in. There are 97 tubes in the boiler, which is 8 ft. 6 in. in length between the tube plates and has an inside diameter of 3 ft. 9 in. The firebox is of the "haystack" type, which is now supposed to be out of date but which has properties that make it specially suitable for service when steam is to be raised very quickly.

While at work on the chain pumps at the Princes Graving Dock, Liverpool, the locomotive was fixed on trestles and the driving wheels were used as flywheels. She was shorn of her coupling rods for reasons of space economy, and the trailing axle and wheels also were removed. These are still in existence, but unfortunately the tender has vanished and no trace of it can be found. The original boiler, together with the haystack firebox, were in operation to the last, and it speaks well for the care and skill of the builders of the locomotive that the original Trevithick pattern regulator and gab reversing gear were still efficient after 90 years of service.

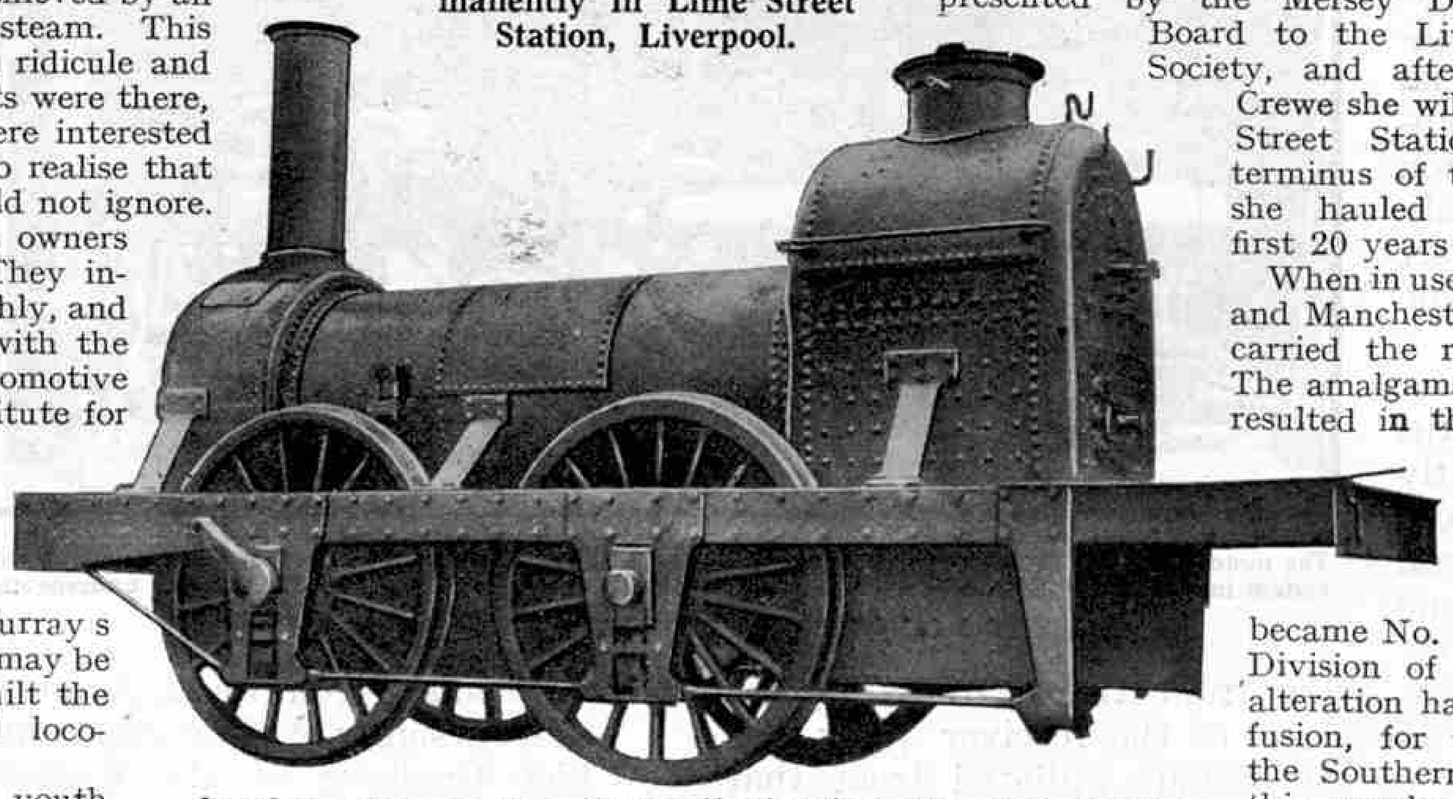


The 92-year old locomotive "*Lion*," which has ceased active work and is to be housed permanently in Lime Street Station, Liverpool.

In 1928 the pumps driven by the "*Lion*" were replaced by others of modern electric type, with the result that the "*Lion*" was at last pensioned off to pass into a well-earned retirement. She was presented by the Mersey Docks and Harbour Board to the Liverpool Engineering Society, and after reconditioning at Crewe she will be housed at Lime Street Station, Liverpool, the terminus of the line over which she hauled trains during the first 20 years of her existence.

When in use on the old Liverpool and Manchester line, the "*Lion*" carried the running number 57. The amalgamation of 1846, which resulted in the formation of the London and North Western Railway, gave rise to a change in number, and the "*Lion*" became No. 116 of the Northern Division of the railway. This alteration has caused some confusion, for two locomotives of the Southern Division also had this number. These were of totally different design to the "*Lion*" however, and were not built by the firm of Todd, Kitson and Laird.

It is interesting to note that one of three locomotives built in 1838 for the Great Western Railway was given the same name as this veteran that has survived 90 years of constant service. The Great Western "*Lion*" was built to run on Brunel's broad gauge line from Paddington to Bristol, and has long since disappeared.



Another view of the "*Lion*," showing the "haystack" type firebox and the built-up plate frame.

Motor Coach Passenger Station

Interesting New York Train Connection Scheme

FOR some time past the Baltimore and Ohio Railroad have been endeavouring to provide improved connections between their Jersey City terminal and the heart of New York, with the object of increasing their passenger traffic. The first step in this direction was the inauguration of a service of motor coaches running in connection with the trains. This service proved successful, but it suffered from the drawback of kerbside loading. This drawback has now been entirely eliminated by the opening of a new coach station on the ground floor of the 56-storey Chanin Building at Forty-second Street and Lexington Avenue.

Coaches conveying passengers from the Jersey City terminus across the Hudson River enter this station, discharge their passengers inside the building, and return to the terminus with outgoing passengers. The whole station is under cover, so that passengers are quite independent of weather conditions.

Photos courtesy] [*Baltimore & Ohio Railroad*

The main lobby of the Baltimore and Ohio motor coach passenger station, New York. The ticket counter is seen on the right.

The arrangements of the coach station have been devised on a most elaborate scale, and the convenience of travellers has been considered in every possible direction. From the main lobby of the station access is provided to the underground railways and to the neighbouring hotels, so that there is no necessity for passengers to cross the street to reach their various destinations.

When a passenger purchases his ticket at the ticket counter, his luggage is checked directly to his seat on the train. An extremely comfortable and attractively furnished waiting room is provided, and there is a special rest room for ladies.

The main lobby is provided with upholstered divans, and has sound-proof telephone cabinets that are extensively used by both incoming and outgoing passengers. A great deal of attention has been given to the lighting of the lobby. Chromium-plated bronze standards support indirect lighting fixtures that resemble the incense-burning braziers of the ancients. From these fixtures the light issues at a point above eye-level, and is thrown up to the ceiling and finally reflected downward. There are also other smaller ceiling lights, and the combined effect closely resembles that of daylight.

There are two separate driveways, for incoming and outgoing coaches. When an incoming coach has discharged its passengers it passes on to an electrically-operated turntable, which places it in position for entering the outgoing driveway opposite the door of the waiting room. It then takes up passengers for the Jersey City terminus, where all Baltimore and Ohio Railroad trains arrive from, and depart for, Philadelphia, Baltimore, Washington, Pittsburgh, Chicago, Cincinnati and elsewhere.

The coaches proceed from the coach station to the train by one of two different routes that have been specially selected, as those affording least traffic interference.

Motor coach taking up passengers inside the coach station for transport to the railway terminus at Jersey City.

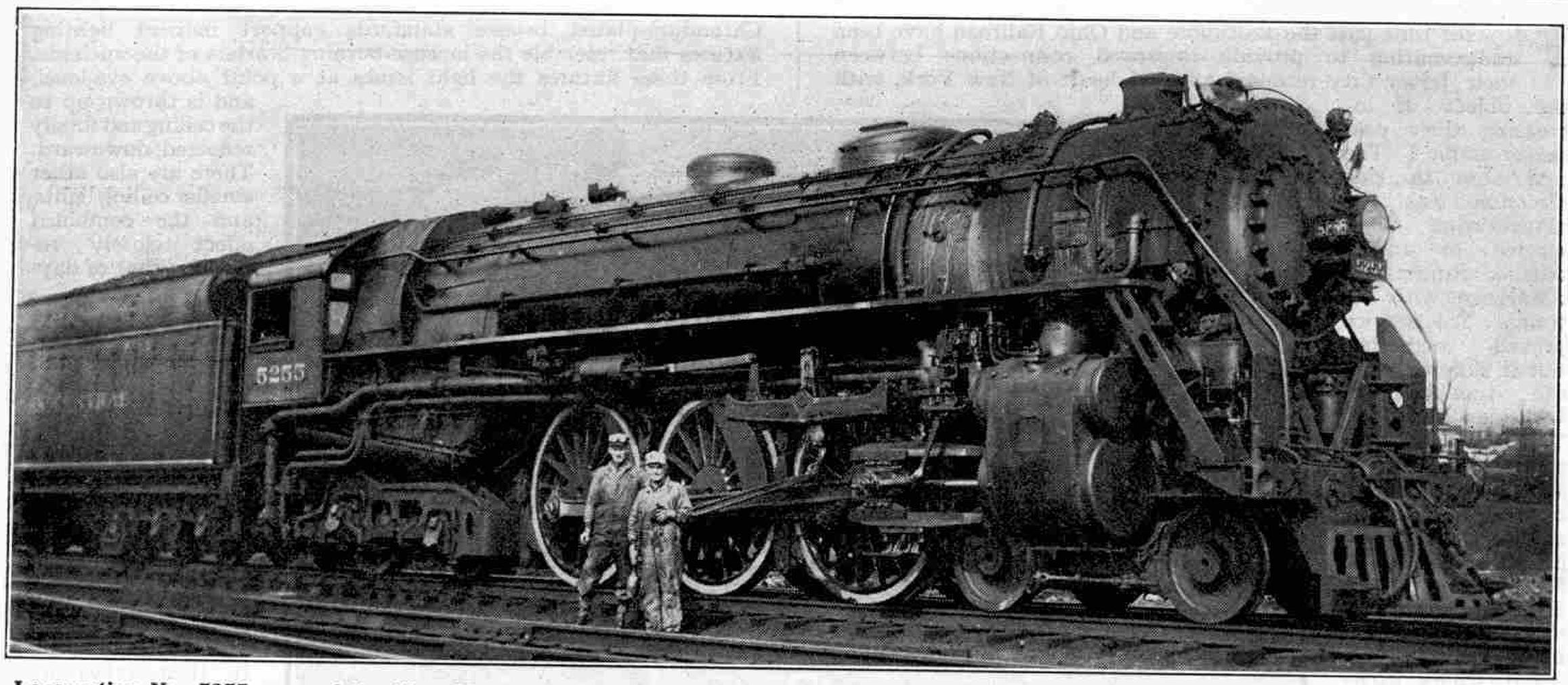
When passengers step into one of the train connection coaches they are relieved of all worry in regard to the possibility of missing their train. This is a point of very considerable importance in view of the traffic congestion in the streets of New York, for the train invariably waits until the arrival of the coach.

An interesting feature of the station is the radio clock, the first to be installed by any railway company in the United States. This clock receives the correct time by radio twice daily from Arlington, Virginia, and automatically makes its own corrections. It controls two secondary clocks, one in the waiting room and the other in the main lobby. The latter clock displays a signal light five minutes before a coach is due to leave for the railway terminus.

Thrills on the "*Twentieth Century Limited*"

Seventy Miles Per Hour on a Giant Locomotive

By Anthony Muto



Locomotive No. 5255, one of the New York Central Lines magnificent "Hudson" type engines, on which the writer of the accompanying article took his thrilling trip from New York to Albany with Bob Butterfield on the first westward lap of the "*Twentieth Century Limited*."

THERE is something about rail-roading that keeps a man young even when he is approaching the age of three score and ten.

It makes the blood surge and I can readily see why Bob Butterfield, crack engineman of the New York Central Lines, retains youthful vitality.

Butterfield is senior engineer of the world-famous "*Twentieth Century Limited*," and five times a week he takes the first section from Harmon to Albany and then returns driving the "*Empire State Express*," the second fastest train on the road.

I rode with Butterfield to Albany on the "*Century*" and back on the "*Empire State*." To my mind, there is nothing more thrilling than riding in the cab of a locomotive leaping along steel rails at seventy miles an hour. It made me want to roar with delight.

The music of the rails is a wild symphony, though the passenger sitting amid the luxury of an ultra-modern train hears and feels nothing of it.

It was 3.31 p.m. when Butterfield got the signal to start. He eased back the throttle of the monstrous "Hudson" type engine, and gently the locomotive picked up her string of ten steel cars. The tattered green flags on the engine waved proudly in the breeze.

I sat on the fireman's box on the left side of the cab and adjusted my goggles. The fireman, W. T. Kelly, busied himself with the automatic stoker.

The great driving wheels were going faster and faster. The wheels hummed and the road stretched ahead 109.5 miles to Albany. Butterfield had to make it in 135 minutes.

Child's play with a "Hudson," he snorted. He could make it in much better time, but the safety rule of the New York Central Lines holds the "*Century*" down to an average of forty-eight miles an hour. Seventy miles an hour is the maximum speed allowed.

To the left was the Hudson River, and soon on the right we would be flanked by sheer rock. The locomotive as it gained speed rocked gently. The drivers pounded an even ryhthm and the great maw of the fire box took the coal with what seemed to me to be a mechanical chewing process. The automatic stokers whirled as mouthful after mouthful of fuel was despatched.

Kelly sat behind me on the box, both of us watching signals. These are the guides and they must be followed:

"Green on red," sang out the fireman.

"Green on red," chanted Butterfield.

Every signal is checked by the engineman and the fireman. Nothing is left to chance.

The speed indicator pointed to fifty miles an hour.

"Yellooooow," sang Kelly.

"Yellow" cried the engineer as he pushed his throttle and applied the air. We were approaching the section where workers were laying a four track system and Butterfield had orders to slow down to thirty miles an hour.

The slow speed was irksome to me. I wanted to feel the leap of steel at seventy. We had to endure the delay until we passed Garrison, and then Butterfield "patted his hog on the back."

He eased the throttle back a few notches at a time and the speed indicator began climbing. Forty — fifty — fifty-five — sixty—sixty-five—seventy.

Now we were riding! The locomotive was fairly leaping. In the cab we rolled with a circular motion. I leaned out and watched the driving wheels. They were going so fast I couldn't see them in detail. Signal posts, houses and stations flashed by. The river, yellow with mud washed down by rains, seemed to swirl.

Butterfield never took his eyes off the road except to look at the watch he held in his left hand. To be late is a cardinal sin.

Ahead I saw the tunnel cut through the toe of a mountain. It curved and the engine was headed straight for the jagged sides of the tunnel which had been carved out of the solid rock.

Curves meant nothing. The heavy engine and the heavier train stuck to the rails and the notes of the symphony became wilder. The shriek of the whistle added to the delirium of joy.

We saw a track pan ahead and Kelly stood by the lever ready to drop the scoop into the trough and get water on the fly. Butterfield reduced speed to fifty miles an hour.

The author of this article is a member of the staff of the "New York Telegram," who sought adventure by travelling with the night air mail from New York to Cleveland; descending to the bottom of the sea in a diver's suit; driving a tank; and riding behind a captious horse along one of New York's busiest thoroughfares during the rush hour.

But he found his greatest thrill in a run with Bob Butterfield from New York to Albany in the cab of the engine of the "Twentieth Century Limited," one of America's most famous trains. His story of this exciting experience is reproduced by permission from the "Telegram," and for the accompanying illustration of the locomotive on which he travelled we are indebted to the New York Central Lines Magazine.

As it dropped I looked behind. A veil of white water obscured the cars.

We were travelling through the beautiful Hudson Valley. Many people think of Albany as being in a straight line from New York, but the curves are countless. They have such a wide radius that it is not necessary to slow down for most of them. A few require a reduction to fifty miles an hour.

A train, southbound, passed us and the rush and roar increased until it was much louder than when running through a tunnel. The rush of air made it hard to breathe.

We were nearing Poughkeepsie, Butterfield began to ease the throttle and as we entered the limits the "*Century*" was doing a mere fifty miles an hour.

"We're just hesitating through here," yelled Butterfield with a smile. His steel-gray eyes twinkled behind his goggles. He seemed like a small boy, eagerly awaiting a clear stretch.

The river began narrowing and the glint of the sun low in the west made water and tracks shimmer with a golden glow.

"Isn't that pretty?" cried Butterfield.

Abandoned ice houses were frequently passed. A grade crossing, one of the few on the line to Albany, loomed ahead.

The track was clear and we were going faster. The indicator pointed to seventy. We were on time. There was a smile of satisfaction on Butterfield's face. The song of the rails is a song of youth. It is rejuvenating.

"Yellooooow!" cried Kelly.

"Yellooooow!" echoed Butterfield.

"That's the train that left New York at two o'clock," Kelly informed me. "Matty Regan's got her. She's late and she might knock us out." Butterfield slowed, and as we passed the yellow signal a whistle sounded in the cab. It was the signal from the automatic train control box on the track reminding the engineer he had just passed a caution light.

We could see the white smoke of the train ahead. We were nearing Hudson and Butterfield became resigned to a speed of between forty and fifty. As we thundered through Hudson the lights were turning from yellow to green and we knew that Matty Regan was giving his engine all the speed it had.

We were on the last stretch. Albany was not far ahead. Seventy—seventy—seventy! That was the song of the engine. The road now was comparatively straight and Butterfield was making up the four minutes he had lost.

I looked down at the tracks. The ties were so close together it looked as if we were passing over a boardwalk. Butterfield pressed the whistle lever. The long-drawn-out scream startled the countryside.

A mile away an automobile was speeding across the tracks. Perhaps the driver was going thirty miles an hour, but to me he seemed to be standing still on the crossing. I thought he would never get over.

The tall buildings of Albany came into sight. The lights were green and the end of the run was in sight. The indicator began dropping. Sixty, fifty, forty, thirty, twenty-five. We were in Rensselaer. The "*Century*" rounded a wide curve and then passed over the bridge spanning the Hudson and we were in Albany. The train slid to a stop as Butterfield's watch hands pointed to 5.46.

Another engineman and fireman swung aboard. They were taking the train to Syracuse. As it steamed out we walked to the crew dispatcher's office, where we waited for the "*Empire State Express*" due to leave at seven o'clock.

On the way to Harmon the "*Empire State*" plunged through the night. Her headlight bored a white shaft through the blackness. I felt alone and at times terrified.

"Too bad there isn't a moon to-night," yelled Butterfield. "It is beautiful going down along this river on a moonlight night."

"I love this game," Butterfield told me after the trip was over. "I'm sixty-two years old and I'm going to keep on patting these hogs until I'm retired for age. My father was seventy-four before he stopped pulling a throttle."

Photograph] [*Railway Photographs, Liverpool*

The east-bound "*Twentieth Century Limited*" at speed near Allston, Mass.; new Pacific locomotive, No. 596.

"Triumph of the Steam Locomotive"

(*Continued from page 677*)

Museum, where it still keeps company with the "*Rocket.*"

The success of the "*Rocket*" at Rainhill had finally settled the question of motive power for the Liverpool and Manchester Railway, and developments now proceeded rapidly. A trial run over the greater part of the line was made on 1st January, 1830, on the completion of a single track across Chat Moss. The train consisted of the "*Rocket*" and a carriage that accommodated the directors, engineers, and their friends. The first trial run between Liverpool and Manchester was made on 14th June, 1830, the train being drawn by a new locomotive the "*Arrow,*" with George Stephenson in charge. On the return journey to Liverpool the "*Arrow*" crossed Chat Moss at a speed of nearly 27 m.p.h.

The public opening of the line took place on the 15th September, 1830, and attracted vast numbers of spectators from all over the country. The ceremony took the form of a procession of eight trains including some 30 carriages that accommodated about 600 people. The eight locomotives employed to haul the trains were all built at Stephenson's Newcastle works and were named respectively "*Northumbrian,*" "*Phœnix*"; "*North Star*"; "*Rocket*"; "*Dart*"; "*Comet*"; "*Arrow*" *and* "*Meteor.*" The "*Northumbrian,*" driven by George Stephenson, headed the procession, and drew a train of three carriages. The first carriage contained a band; the second accommodated the Duke of Wellington, Sir Robert Peel, William Huskisson, a Liverpool M.P., and other notable people; and in the third were the directors of the railway. The Duke's train proceeded along the south track and the other seven trains along the north track.

The procession was cheered enthusiastically by thousands of spectators as it proceeded along the route. At Parkside, about 17 miles from Liverpool, the locomotives stopped for a supply of water. During the halt Huskisson got down from the directors' carriage and was standing in the north track when the "*Rocket*" was seen to be rapidly approaching. Huskisson quickly climbed the ladder of the carriage and grasped the handle of the door. The door immediately swung back and the unfortunate man, apparently losing his nerve, let go and fell in front of the oncoming train, the wheels of the first two carriages of which passed over one of his legs. His first words on being raised were: "I have met my death." The two rear carriages of the Duke's train were quickly detached and Huskisson was placed in the remaining carriage and conveyed to the parsonage of Eccles. There, in spite of every medical attention he died a few hours later.

This accident naturally cast a gloom over the proceedings. The Duke of Wellington was particularly distressed and expressed the wish that the procession should return to Liverpool; but ultimately he was persuaded to continue with the programme.

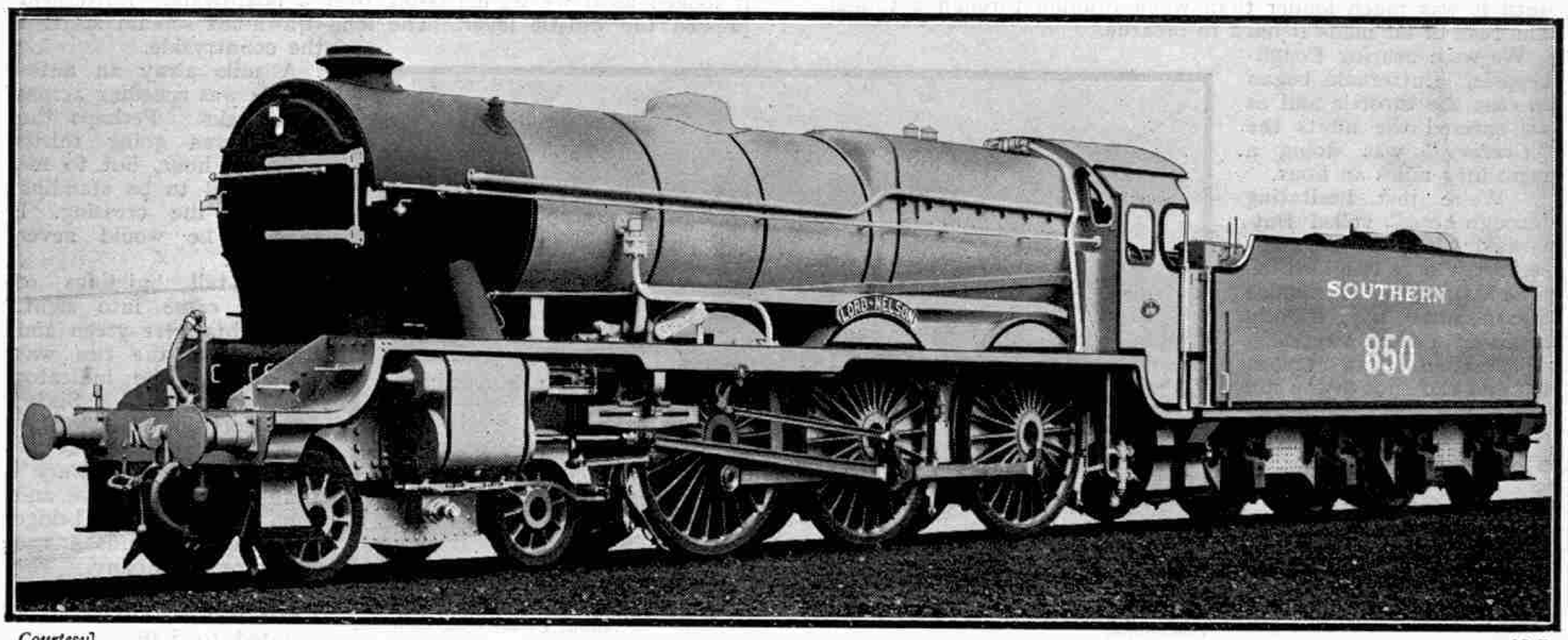
Throughout the route the procession was cheered wildly by the majority of the spectators, only those who were for some reason opposed to railways showed their disapproval by booing. At various points stones were thrown at the carriages as they passed along. Extraordinary scenes occurred at the Manchester Station, where a vast crowd had become impatient and got out of control of the troops who were present to keep order. As soon as the trains arrived, the people made a wild rush towards them, and in a minute were clambering all over the carriages. The Duke remained in his seat, shaking hands with women and children who were pushed forward by the great crowd behind them. Ultimately order was restored and the trains began their return journey,.

On the following day the Liverpool and Manchester Railway was opened for public traffic, the first train to Manchester conveying 140 passengers and completing the journey in the allotted time of two hours. Shortly after its opening the railway was carrying an average of some 1,200 passengers daily, and five years later it was conveying nearly 500,000 passengers per year.

We are indebted to the L.M.S.R. for the loan of some illustrations for this article.

The Locomotive—Its Development and Future

A Lecture by J. Clayton, M.B.E., M.I.Mech.E.



Courtesy] [*S.R.*

S.R. Locomotive No. E.850, "*Lord Nelson*." This has four cylinders, and eight impulses are given to the driving wheels at every revolution.

AT the first meeting of the Southern Railway (Brighton Area) Engineering Society, held 4th October, 1929, a lecture on the development of the locomotive was given by Mr. J. Clayton, Personal Assistant to Mr. R. E. L. Maunsell, O.B.E., Chief Mechanical Engineer of the Southern Railway. After remarking upon the importance of railways and giving figures illustrating their magnitude, Mr. Clayton went on to trace the history of the locomotive from its earliest days.

"Four years ago," he said, "we celebrated the centenary of the first public railway in the world, the Stockton and Darlington Railway, which was opened on September 27th, 1825. The locomotive used on that occasion now stands on the platform in Darlington Station, and is named "*Locomotion*." After that came the famous project for a railway between Liverpool and Manchester of which George Stephenson was the engineer, and a prize of £500 was offered for a steam locomotive to fulfil the interesting conditions required, which were as follows :—

1.—The engine must consume its own smoke.

2.—If the engine weighs six tons it must draw on the level 20 tons including its own weight, and with a steam pressure of 50 lb. per sq. in.

3.—There must be two safety valves out of control of the enginemen and neither must be fastened down while the engine is working.

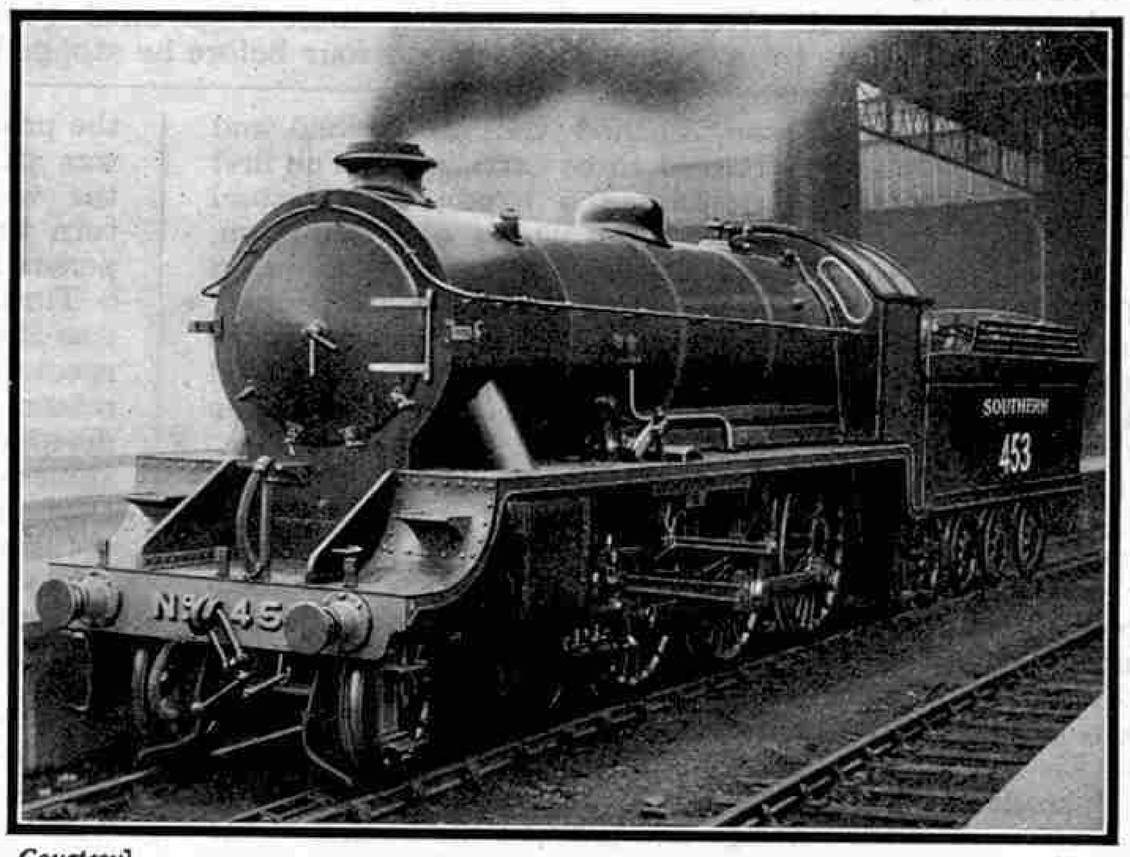
4.—The height from ground to top of chimney must not exceed 15 ft.

5.—The weight of the engine is not to exceed six tons and one of less weight is preferred.

6.—The price of the engine is not to exceed £550 delivered.

"The trials were conducted at Rainhill, nine miles from Liverpool, and the "*Rocket*" by George Stephenson was accredited an easy winner. The "*Rocket*" with its tender weighed seven tons nine cwts. and hauled 12 tons at a speed of 15 miles per hour. The grate area was six sq. ft., and the heating surface 138 sq. ft., the working pressure being 50 lb. per sq. in.

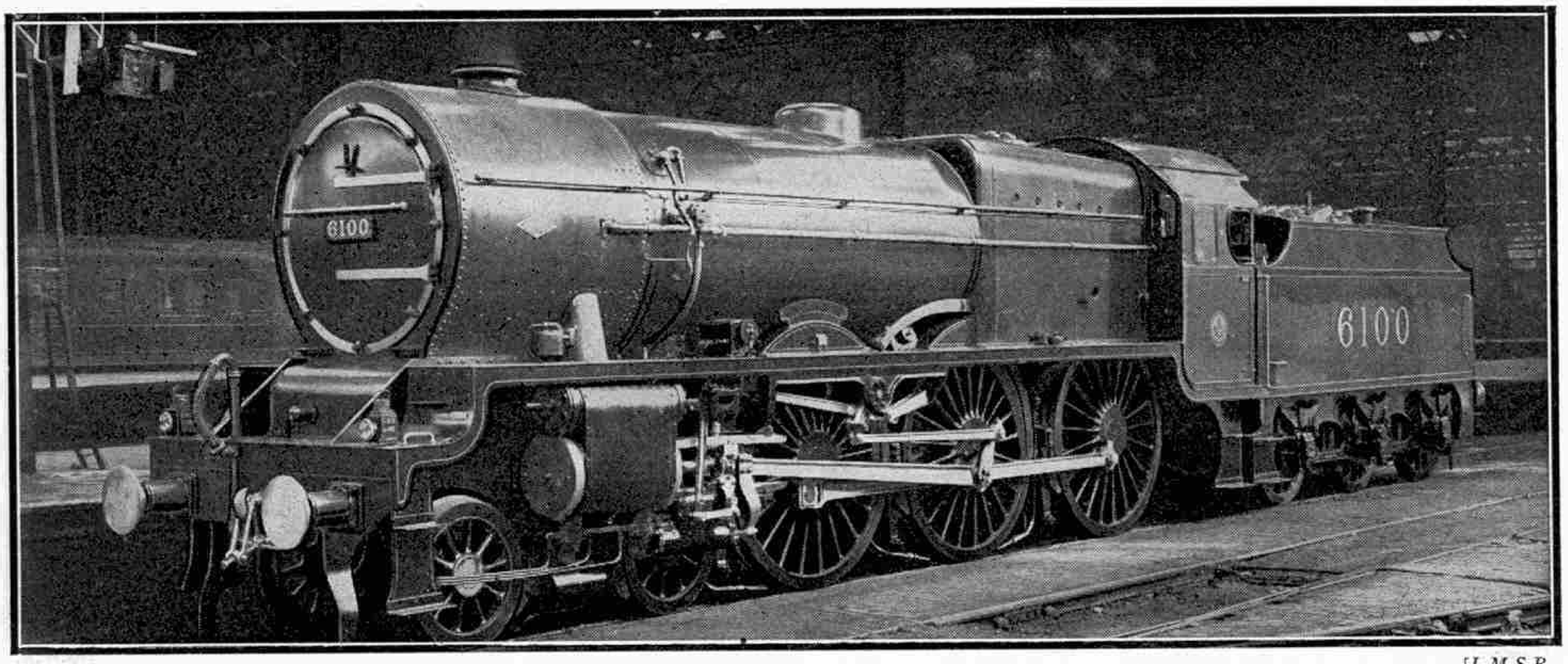
"Since that time the locomotive has grown from those small dimensions until the latest locomotives fill, or nearly so, the construction gauge limiting its size, while the weight has reached the maximum which the bridges and road bed can safely carry. So that to-day we have the "*King George V*" and the "*Caerphilly Castle*," the "*Enterprise*" and "*Flying Scotsman*," the "*King Arthur*" and the "*Lord Nelson*" and the "*Royal Scot*." The last-named locomotive embodies the last word in progress, weighing well over 140 tons, with 33 sq. ft. of grate area, from 2,000 to 3,000 sq. ft. of heating surface, and a working pressure of 250 lb. per sq. in. It is capable of hauling trains of 500 tons weight at upwards of 60 miles per hour regularly and economically.



Courtesy] [*S.R.*

S.R. 4–6–0 Locomotive No. E.453, "*King Arthur*," the first of a class of two-cylinder engines that are simple in design and economical in operation.

"The locomotive of to-day is a worthy and wonderful achievement after 100 years of useful locomotive life. Yet we cannot say that we have reached the limits of possibility even in the steam locomotive. Young engineers need not lose heart and think that after all this progress and achievement there are no more worlds to conquer. The more we progress the greater the ability to continue progress. It has been said that 'necessity is the mother of invention' and with even greater truth it may be asserted that 'progress makes possible greater necessities.' So do not entertain for one moment the idea that, the steam locomotive having reached such a magnificent position, your chances in this branch of engineering are small. I remember the same idea was sung 40 years ago when I commenced my career. In my time—and I am not old—we have seen the introduction and development of the electric train, the telephone, the motor car and the cinematograph, the steam turbine, wireless telegraphy, submarines, aeroplanes capable of travelling from London to Brighton in nine minutes, and airships that encircle the whole world.



Courtesy] [*L.M.S.R*

L.M.S. 4–6–0 Locomotive No. 6100, "*Royal Scot*," an engine of modern design. Locomotive No. 6113, "*Cameronian*," an engine of the same class, has a fine non-stop run from Euston to Glasgow to its credit.

" I only mention these in order to show that the prospects of engineering development are boundless and great as have been our past achievements, these have revealed greater possibilities. We always judge of the future by our past experience, and we know that these changes do not occur suddenly, but by slow and gradual development, and afford the opportunity, if we are sufficiently alert, to allow us to accommodate ourselves to the new and altered conditions. Suppose, for instance, that the electric or internal combustion locomotive should supersede the old steam locomotive; who are the best men to undertake the provision of the new order? Why, those who have had experience of the older forms. It is a fact that electric traction was not a success until the problem was tackled in the steam locomotive way."

Mr. Clayton then reviewed the present position, and indicated the lines along which improvement may be looked for.

" Turning to the possibilities of improvement of the steam locomotive," he said, " we need only consider the fact that one-fifth of the total locomotive revenue expenditure of a railway is required by the coal bill, and that under the most favourable conditions only from five to seven per cent. of this represents useful work done, to realise what a field there is still to be conquered by those who can and will. More efficient combustion of coal and more efficient methods of superheating the steam and its distribution and consumption are waiting to be exploited, and so who would say the opportunities are exhausted?

" Let me, at this point, indicate one or two directions in which there appears to be opportunity for improvement. Take first the locomotive boiler. The best instances show an efficiency under the most favourable conditions with a superheater of, say 70 to 80 per cent., while the average is probably not more than 55 to 65 per cent., leaving quite a margin for conquest of, say 30 per cent. Now what is it that accounts for this loss? Largely the crude way in which the coal or fuel is burnt or decomposed in order to liberate its heat energy.

" If the coal could be coked in a closed chamber and thus induced to give up its energy in the form of oil or gas which could be burnt as an incandescent flame, we might better harness this wonderful power derived from the sun, known to us now as coal, a hard black substance, generally burnt in an open fire, a process that wastes a large proportion of its energy.

" An experiment is shortly to be carried out by Mr. R. E. L. Maunsell, Chief Mechanical Engineer of the Southern Railway, who has fitted one of the " U " class passenger engines, No. A.629, with apparatus for burning pulverised fuel. The object of such a trial is to find if the application can be made a success in railway working. It is hoped to increase the efficiency of the boiler and to obtain a considerable saving in coal thereby.

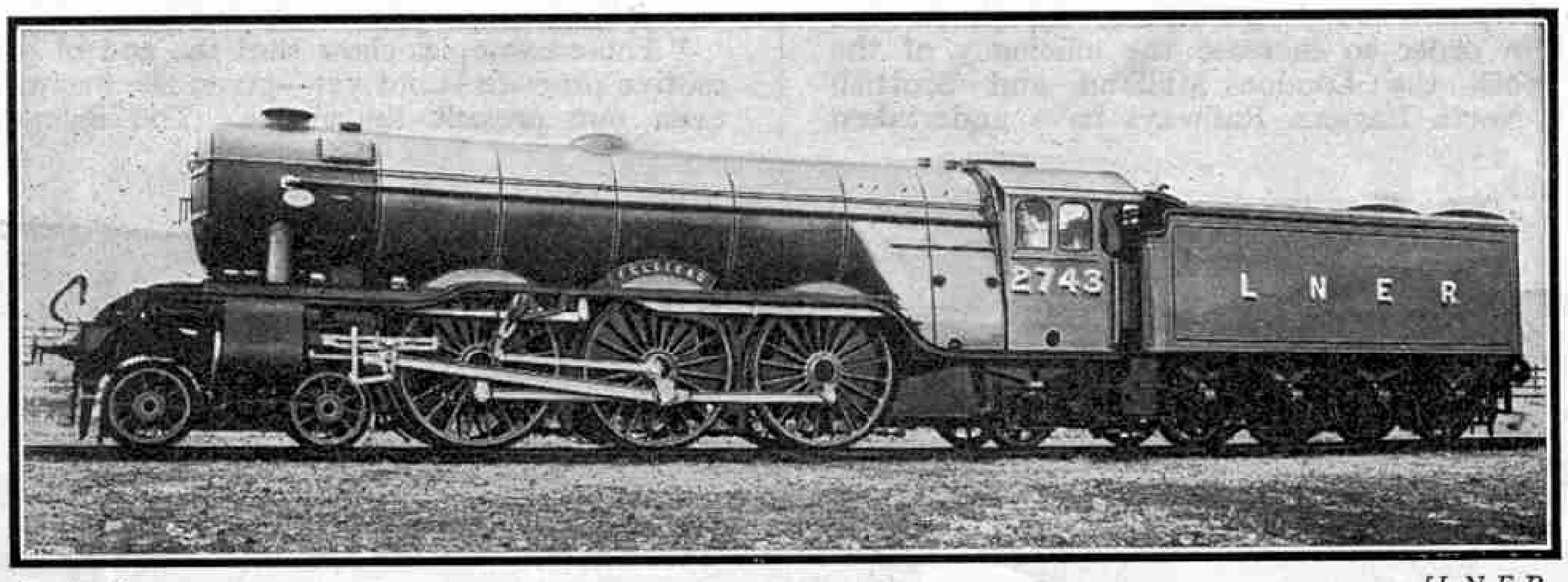
" The coal is to be pulverised or powdered in a special plant at the running shed and the required quantity fed into a special container carried on the tender of the locomotive. The bottom of the tender container is suitably formed to take the feed screws which carry the fuel forward with the aid of air, forced under pressure from a fan. The screws are actuated by a small auxiliary steam engine also carried on the tender.

" The fuel is fed to the engine through two large pipes, one on either side, to the slit burners placed on each side of the ashpan. The ashpan consists of a brick-lined chamber in which combustion takes place. The firebox is therefore not used in the usual way. There is no firegrate and thus it becomes merely a chamber of incandescent flame. The brick arch is maintained as now, and has the effect of causing the flame to fill the firebox completely. The firedoor is kept closed under all conditions of working.

" The work of the fireman consists not in shovelling coal, or firing as we call it, but in looking after the auxiliary machinery, to see that the fuel is being regularly fed forward to the burners so as to maintain the steam pressure and to ensure at the same time that the water level in the boiler is being maintained. A small pilot burner is also provided in the centre at the back of the ashpan for use in maintaining the flame when steam is shut off for long periods or when standing.

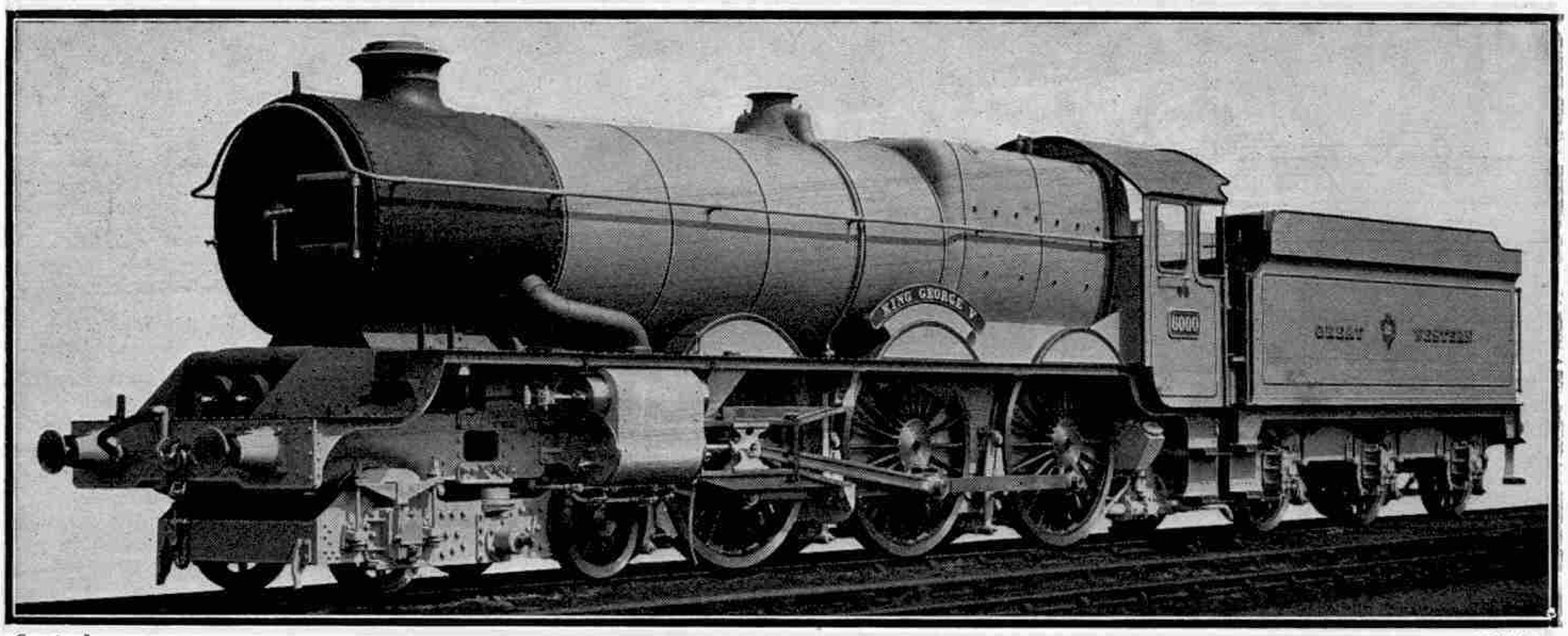
" Briefly the advantages to be obtained by the use of pulverised fuel are an absence of smoke and sparks, higher boiler output for long periods and maintenance of steady boiler pressure. The fireman is relieved of hard manual labour; no fires to clean and very little ash to remove from ashpan and smokebox. The tender can be fuelled as easily as taking water. Lighting up is a simple operation performed by igniting the pilot burner flame and fine slack or low grade fuel can be usefully employed.

" The important consideration in connection with the system



Courtesy] [*L.N.E.R.*

L.N.E.R. No. 2743, "*Felstead*," one of the high-pressure " Pacifics " built at Doncaster. Attached to the locomotive is a corridor tender of the type used on long distance non-stop runs.



Courtesy] [*G.W.R.*

"*King George V*," the magnificent 4-cylinder 4–6–0 G.W.R. Passenger Locomotive that created great enthusiasm in America on its visit to the Centenary Celebrations of the Baltimore and Ohio Railroad.

is the provision of a suitable plant for pulverising the fuel. This presents no serious difficulties, and is now a well-tried practice. The plant consists of a crusher—only required when the coal is large—a pulveriser which grinds the coal into powder like fine flour, and an arrangement, or separator, to extract the air from the stream of fuel before passing it to the tender container.

"Containers of special design can be used for conveyance of the fuel which can be handled and stored with much less precaution than is necessary with oil or petrol."

Experiments now being made with high pressure locomotives and with new forms of valve gear then were referred to.

"The use of higher steam pressures is now being exploited in several directions," proceeded Mr. Clayton, "both in this country and abroad in order to increase the efficiency of the steam locomotive. Both the London Midland and Scottish and the London and North Eastern Railways have undertaken the construction of such locomotives, the former using a pressure of over 900 lb. per sq. in., the boiler being of the Schmidt-Henschel type, while the latter has a water tube boiler of the Yarrow type having a working pressure of 450 lb. per sq. in.

"Thus two important endeavours are being made to improve the locomotive boiler. What of the engine that is to use the steam? Here again progress is being made, and the ordinary distribution or piston valves, as we know them, appear likely to give place to some form of poppet or lift valve. Two systems employing these valves are already in use on the Continent and to a small extent in this country. These are the Lentz and the Caprotti.

"The Lentz system actuates the double beat poppet valve by means of reciprocating or partially revolving cams through the medium of the ordinary valve motion.

"The Caprotti system employs the well-known motor car or internal combustion engine practice with revolving cams for lifting the double beat poppet valves.

"In each of these systems separate valves are provided for the steam and exhaust, but in the Lentz system reversing is effected through the ordinary expansion link, while in the Caprotti system, sliding cams of different form accomplish the reverse. The point of these two applications turns upon the acceptance of compromise, as in the Lentz, or of the more perfect, as in the Caprotti. The latter entails much more alteration and addition to existing engines, and is, therefore, more costly to apply.

"The Lentz system retains the existing link motion and reverse gear, while the Caprotti uses no link motion, but instead takes revolving motion from the axle either through bevels or worm drive for the cams and employs universal joints to allow for rise and fall of the engine on its springs.

"These examples show that the end of progress in steam locomotive practice is not yet—given the means and the will to apply even our present knowledge. The locomotive profession was never so much alive and go-ahead as it is to-day. Never were those concerned so keen on taking advantage of every possible improvement. Traffic requirements become more and more insistent, but seldom do our locomotive engineers fail to satisfy the demands made upon them."

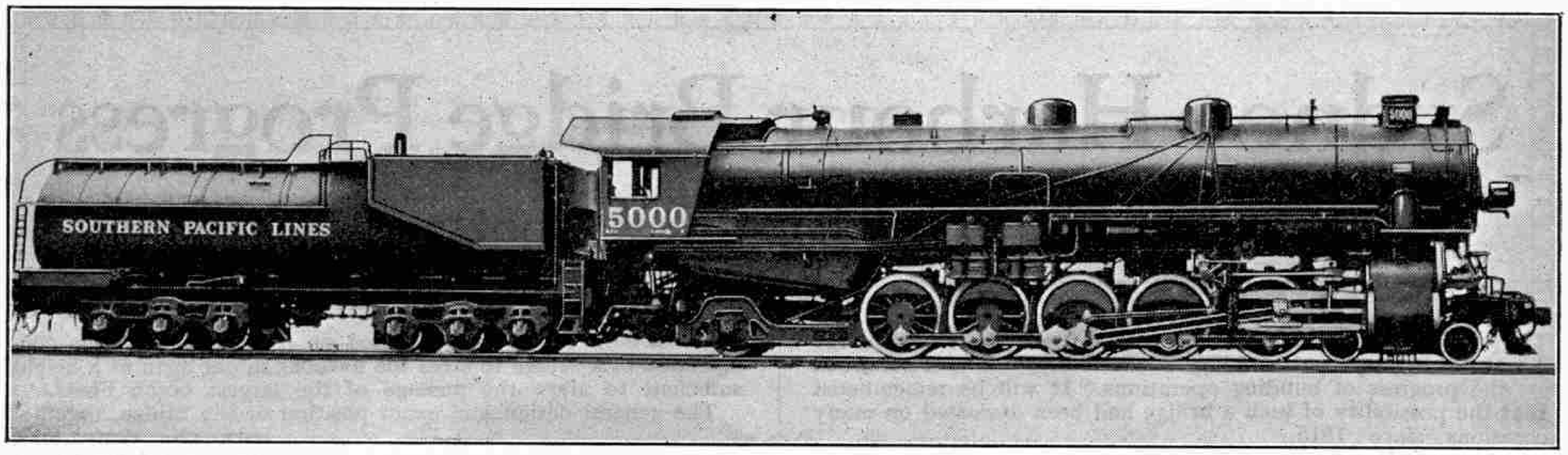
Mr. Clayton concluded his lecture with a few words on the prospects of the engineer. He believes that the opportunities ahead are equally as good as those enjoyed by the great engineers of the past.

"We have to look to the young engineer with new ideas and undimmed vision for the solution of locomotive problems in the future," he pointed out, adding that they would be "aided and steadied by the older folks who have the experience of the past to draw upon.

"The future of our railways holds tremendous possibilities for the young engineer who is willing to put his best into it," Mr. Clayton continued. "The work, if it is to be done well, is not, however, easy. Every opportunity must be embraced by

Courtesy] [*Beyer Peacock & Co.*

The L.N.E.R. "Garratt" Locomotive No. 2395, built in 1925, that is used for banking on the Worsboro' branch between Wath and Penistone. It weighs 168 tons and is the most powerful locomotive in the British Isles, its tractive effort being 72,940 lb.



On the American Continent the locomotive designer has been able to develop his ideas with comparative freedom owing to the absence of loading gauge restrictions such as prevail in this country. A typical example of the result of this freedom is the three-cylinder Southern Pacific locomotive shown above. This locomotive is used for hauling both freight and passenger traffic over the Sierra Nevada Mountains, and with a train of 13 steel passenger cars it can maintain an average speed of 20 m.p.h. up the steep grades.

young men to make themselves thoroughly efficient. Work, whatever it is, should be undertaken with zeal because it is worth while. Thoroughness in the smallest detail must be the keynote of all endeavours, and no matter how insignificant a part of the whole one may seem called upon to perform, it must be done as though it were the vital thing.

"Let us look round the works for a moment. Here is a young man turning small details like brake pins, quite small parts of the engine or carriage. Yes! but think how important their function when the brake is applied to bring the train from speed to rest. The small pipes leading to the axlebox that are being put upon this engine are very insignificant. Yes! but they carry the life blood to the axle journals and make it possible to run the train with ease and at a speed. They must function properly or hot boxes will result. The engine then will have to be stopped and lifted, and while it is out of service the loss to the revenue is probably at least £20, possibly even £50 per day.

"This young man is engaged riveting up that smokebox bottom, good and tight, to prevent the smokebox drawing air at that point; or that fireman has just closed and fastened the smokebox door, and, of course, he was careful to see that the joint of the door was clean and free from obstruction. Now either of these small and apparently unimportant jobs must be properly done or they may mean the loss of pounds of coal per mile before the defect is discovered.

"So one could go on multiplying the importance of little things done every day, but just as every school boy aspires to become head boy of his class, so every youth in the workshop looks forward to being able one day to lead in his work. Ability to lead only comes by close attention to work and the accumulation of practical experience from actually doing the job time after time. George Stephenson is reported to have said 'It is easy to engineer matter, but it is hard to engineer men.' Such experience cannot be obtained by reading books on the subject or merely watching others do it; but from real knowledge of the work in all its phases gained by the arduous and often rugged ways of toil, hard work and study."

For permission to reprint this interesting address we are indebted to the courtesy of the Editor of the "*Southern Railway Magazine.*"

The Liverpool and Manchester Railway

(*Continued from page 679*)

Stephenson had to drive a cutting for the railway. Even to-day the excavation of Olive Mount cutting —which by the way is only a few minutes' walk from the factory where Hornby Trains are made— would be considered a formidable task, for it involved the removal of nearly 500,000 cu. yds. of rock. In Stephenson's time, when there were few skilled workmen and fewer labour-saving devices, the achievement was all the more remarkable. The cutting extends for over two miles through the solid rock and in places the walls rise to a height of over 100 ft.

Between the Olive Mount cutting and Liverpool is another ridge of sandstone through which it was necessary to cut a tunnel 1¼ miles in length. The first shaft was sunk in October 1826, and other shafts followed at varying distances apart. Two-thirds of the tunnel was cut through solid rock, the remaining portions being excavated through shaly sand and clay. The making of this tunnel proved a very difficult job, and during the work Stephenson's colliery experience in blasting and hewing rock was of great service. On several occasions water penetrated into the workings, and when wet sand was encountered it became necessary to prop and under-pin the roof until a strong brick lining could be built up at that point. More than once the workmen refused to continue with so dangerous a task. On one of these occasions Stephenson saved the situation by taking off his coat, picking up a spade and making his way into the workings. For an instant his men hesitated, and then his calm courage had its effect and they followed him into the tunnel to continue work.

An interesting account of the tunnel operations appears in the "*Mechanics' Magazine*" of 1841, and records that the "perilous labours, carried on by the light of candles—one party of workmen relieving another at stated intervals—were conducted night and day for upwards of twelve months, when a clear passage was effected from end to end. The materials thus removed . . . . were drawn up the several shafts, some of which were above twenty yards in depth, to the surface by means of horse gins, and were disposed of in elevating the site of intended streets, and filling up delfs and hollows in the neighbourhood."

The tunnel enabled the railway to be laid directly to the docks without disturbing a single street. It extended from Wapping to Edge Hill, and was cut 22 ft. in width and 16 ft. in height throughout its length. The tunnel inclined upward from a point about 270 yd. from the Wapping entrance at a gradient of 1 in 48, the upper mouth being 123 ft. above the entrance at the docks. When the railway was in operation goods wagons were hauled up this steep incline by means of ropes passing over pulleys, a double row of which were fixed above ground throughout the length of the tunnel. The ropes were wound in and paid out by a stationary steam engine installed in one of the two tall stone buildings at the Edge Hill end of the tunnel; the other building accommodated a second stationary engine kept as a reserve. The sides and roof of the tunnel were white-washed and illumination was provided by a series of gas lamps suspended from the roof. When completed, the tunnel was open for public inspection one day a week. Thousands of people came to view the great engineering achievement and a charge of one shilling each was made for admission, the money thus raised being devoted to the support of the families of labourers who had been injured on the line, and to the Manchester and Liverpool Infirmaries. At that time the tunnel accommodated a double track, but it has since been opened up and is now traversed by four lines of railway.

From Edge Hill a second and shorter tunnel was cut, at the same gradient as the main tunnel, for a distance of 290 yd., the upper mouth being at Crown Street, where the passenger station was erected.

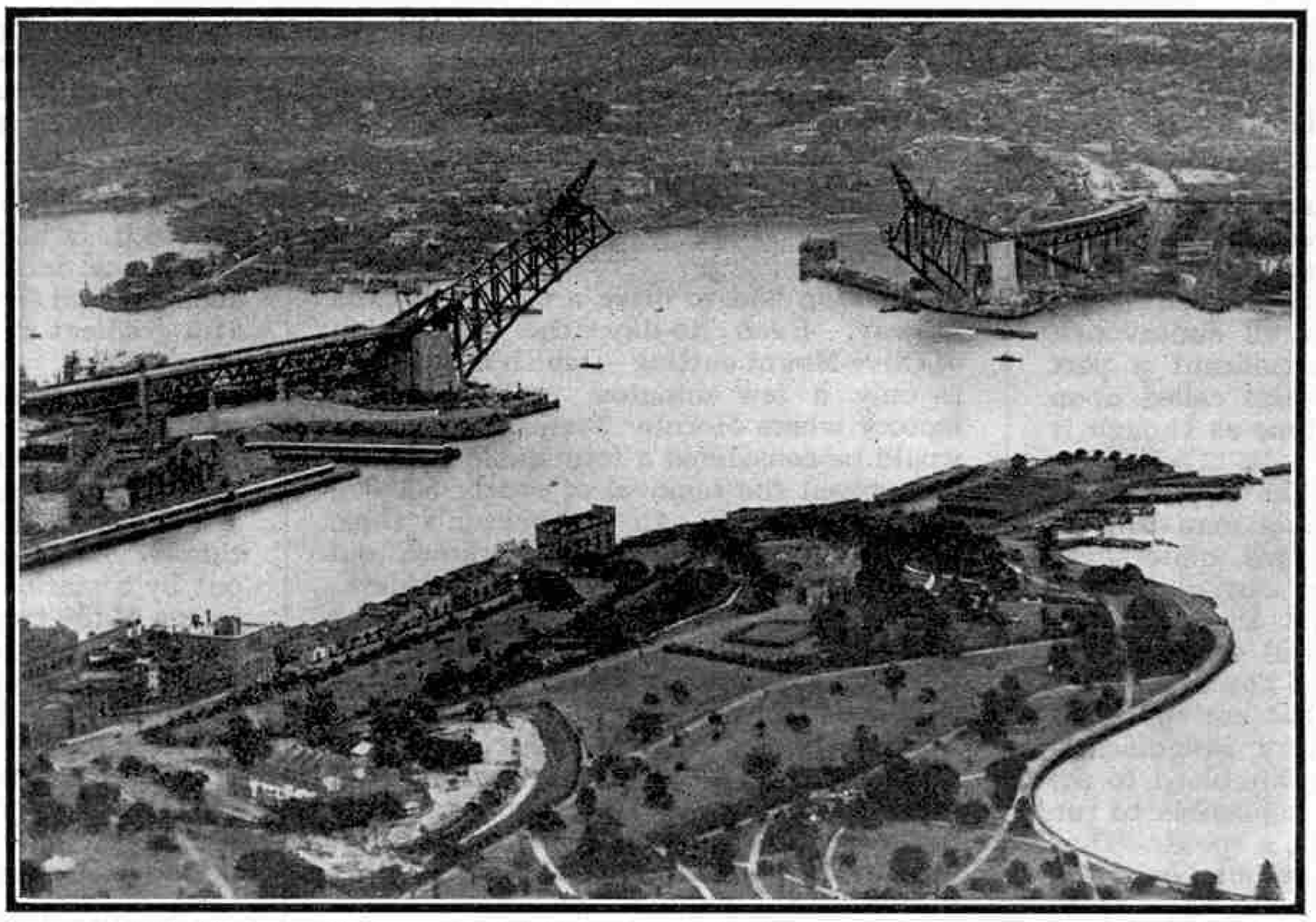
During the construction of the railway the company obtained the sanction of Parliament to carry the line across the river Irwell into Manchester, and to improve the curves and shorten the line near Rainhill. The railway crossed many roads and streams, necessitating the construction of no less than 63 bridges under or over the line. These bridges were built to Stephenson's own designs and were of various types, including "skew" bridges, then quite an innovation. The most important skew bridge was erected at Rainhill to carry the main road over the railway. This bridge cost £3,735, and crosses the railway at an angle of 34 degrees.

One of the largest tasks in bridge construction made necessary by the railway was the £45,000 viaduct over the Sankey Brook, and canal. This viaduct consists of nine arches each of 50 ft. span, and carries the railway across the valley at a height of 70 ft.

Sydney Harbour Bridge Progress

A World's Record in Steel Construction

IN previous issues we have dealt with the scheme for the bridge across Sydney Harbour, New South Wales, and have described the progress of building operations. It will be remembered that the possibility of such a bridge had been discussed on many occasions since 1815, when Francis H. Greenway, then Government Architect, brought a scheme before the notice of Governor Macquarie. Some years later, in a letter to the press, Greenway wrote:—" . . . . . in the event of the bridge being thrown across from Dawes Battery to the North Shore, a town would be built on that shore, and would have formed with these buildings a grand whole that would have indeed surprised anyone on entering the harbour, and have given an idea of strength and magnificence that would have reflected credit and glory on the Colony and the Mother Country."



A view of the Sydney Harbour Bridge taken recently from an aeroplane above the Sydney Botanical Gardens, showing the southern or city side on the left and the northern arm of the arch on the right.

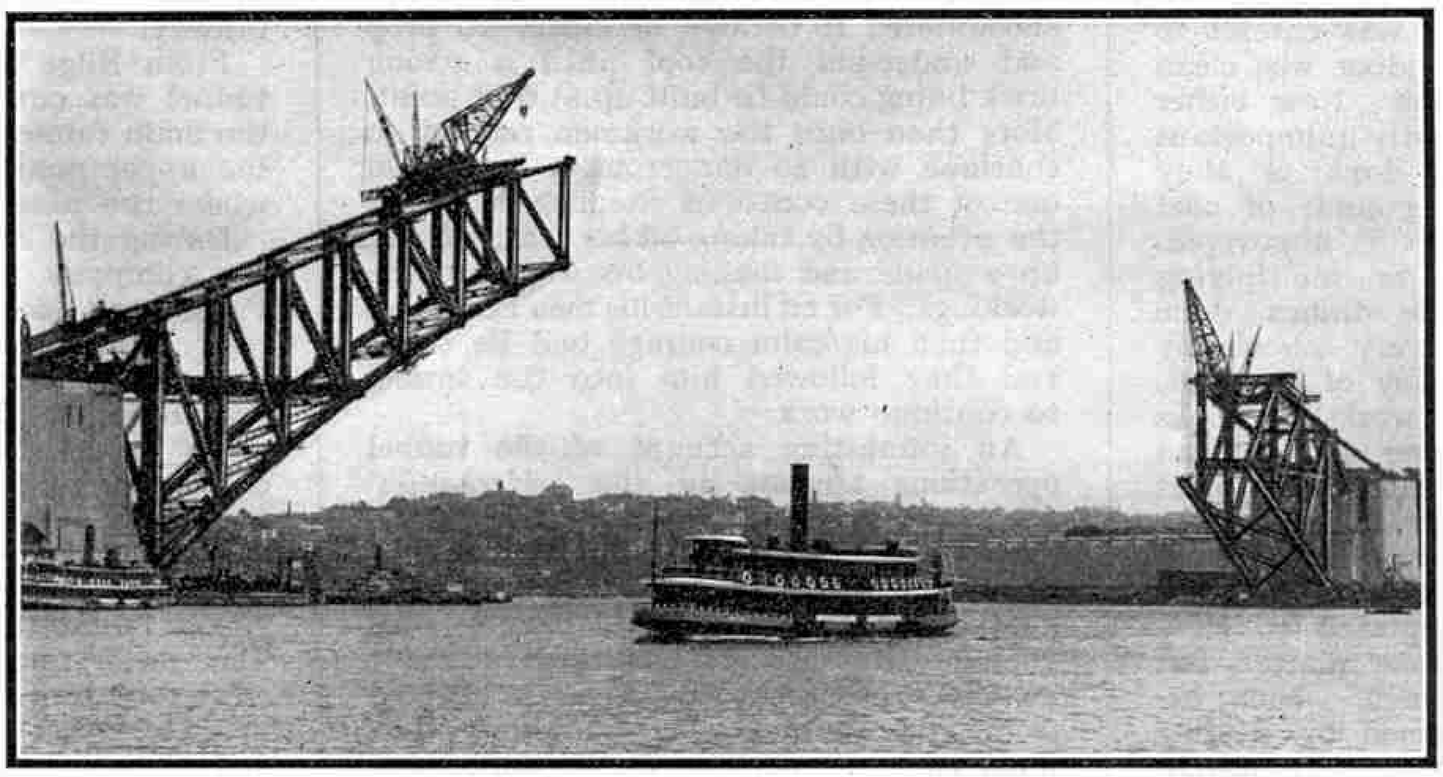
The first recorded design seems to have been prepared in 1857 by one Peter Henderson and at a more favourable time it is possible that his bridge might have been built. His scheme was unable to survive the local opposition, however, this being based upon the fear that if two bullock wagons happened to meet in the centre the structure might collapse!

The problem of connecting the two shores was considered seriously in 1912 by a committee specially formed for the purpose and the main question to be decided was whether a bridge or a tunnel would be the more suitable. The committee decided that a bridge was preferable and, after examining carefully various schemes submitted, advised the construction of a cantilever bridge.

The necessity for a bridge increased rapidly during the early years of the present century. By 1921 the traffic across the harbour had increased to 42 million passengers and it was admitted on all sides that something must be done at once. The bridge question was then re-opened in earnest, the recommendations of the 1912 committee were accepted, and in the following year the Government of New South Wales passed an Act authorising the construction of a bridge to cross the harbour in one span at a height sufficient to allow the passage of the largest ocean liners.

The general design and exact position of the bridge, together with the dimensions, etc., were defined by a specification drawn up by Dr. J. J. C. Bradfield, M.E., M.I.C.E., formerly Chief Engineer of the Metropolitan Railway Construction, Public Works Department, New South Wales, and subsequently appointed to be Chief Engineer for the bridge. Tenders were invited from a number of engineering firms in all parts of the world, and competition was very keen. After careful examination of the tenders and designs, and after repeated Cabinet meetings, the Government came to a decision, and in February 1924, it was announced that the contract had been awarded to Dorman, Long & Co. Ltd., of Middlesbrough, who had submitted seven alternative tenders for arch and cantilever bridges.

The successful tender was for an arch bridge with a central suspended span to extend across the harbour to Milson's Point. As has already been mentioned, the Government had leaned towards the idea of a cantilever bridge—in fact, the original specifications called for a cantilever solely. The suggestion for an arch bridge was advanced partly on the ground that the cost would be appreciably less, and also because it was believed that the arch type would present a more pleasing appearance.



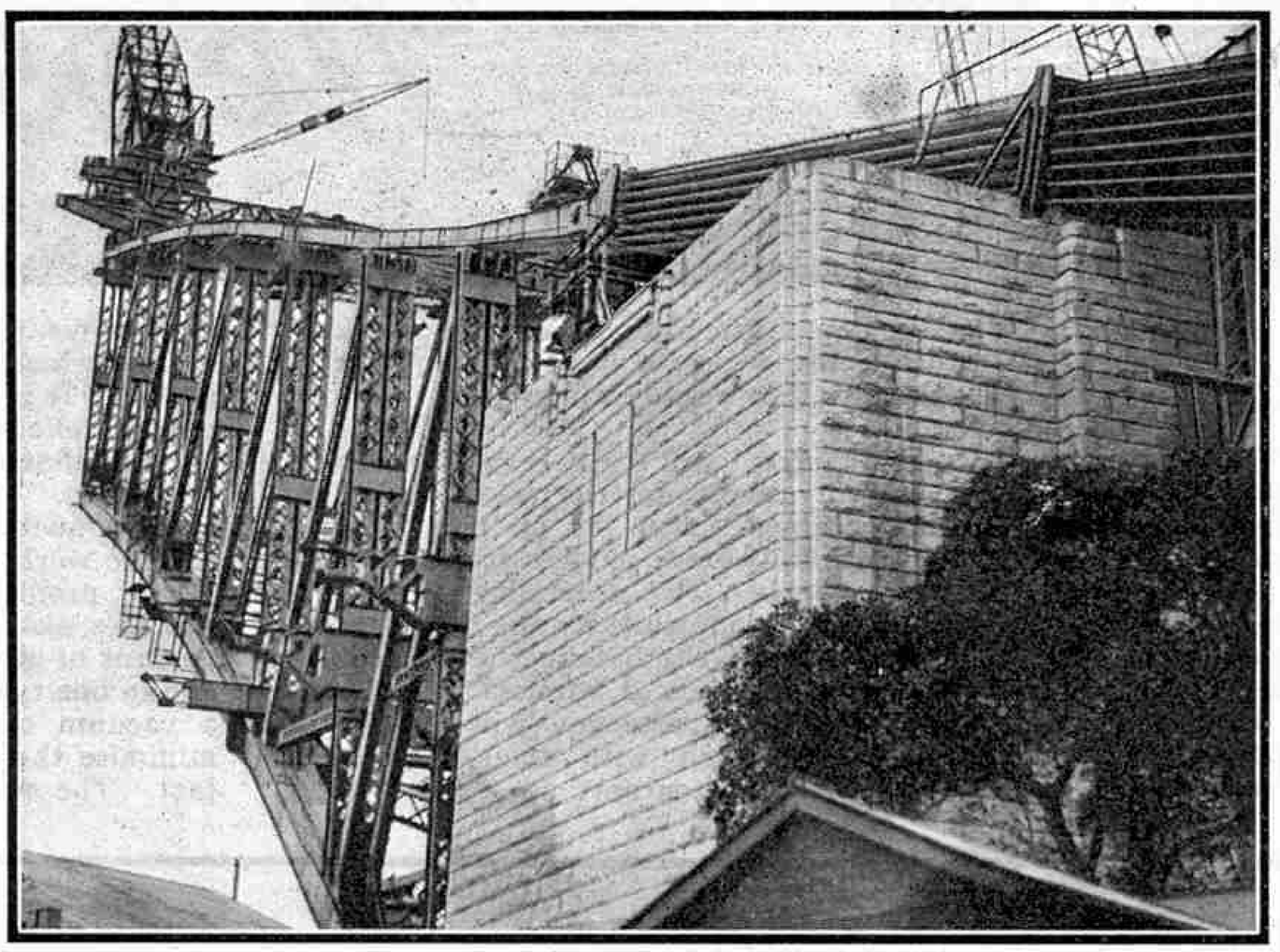
Another view of the bridge, illustrating the danger to passing ferries and other shipping from falling rivets or tools. In March a workman was killed by falling from one of the panels of the bridge into the water, a distance of 190 ft.

The contract stipulated that constructional operations were to be carried on simultaneously on both sides of the harbour, and the time limit for the work was fixed at six years from the date of notification of acceptance of the tender, unless a special extension should be granted by the Australian Government.

The bridge will have a total width of 150 ft. and will carry two lines of railway for electric trains of 4 ft. 8½ in. gauge, a road 57 ft. in width, and two footpaths each 10 ft. in width. The

highest point of the arch will be 445 ft. above high-water level.

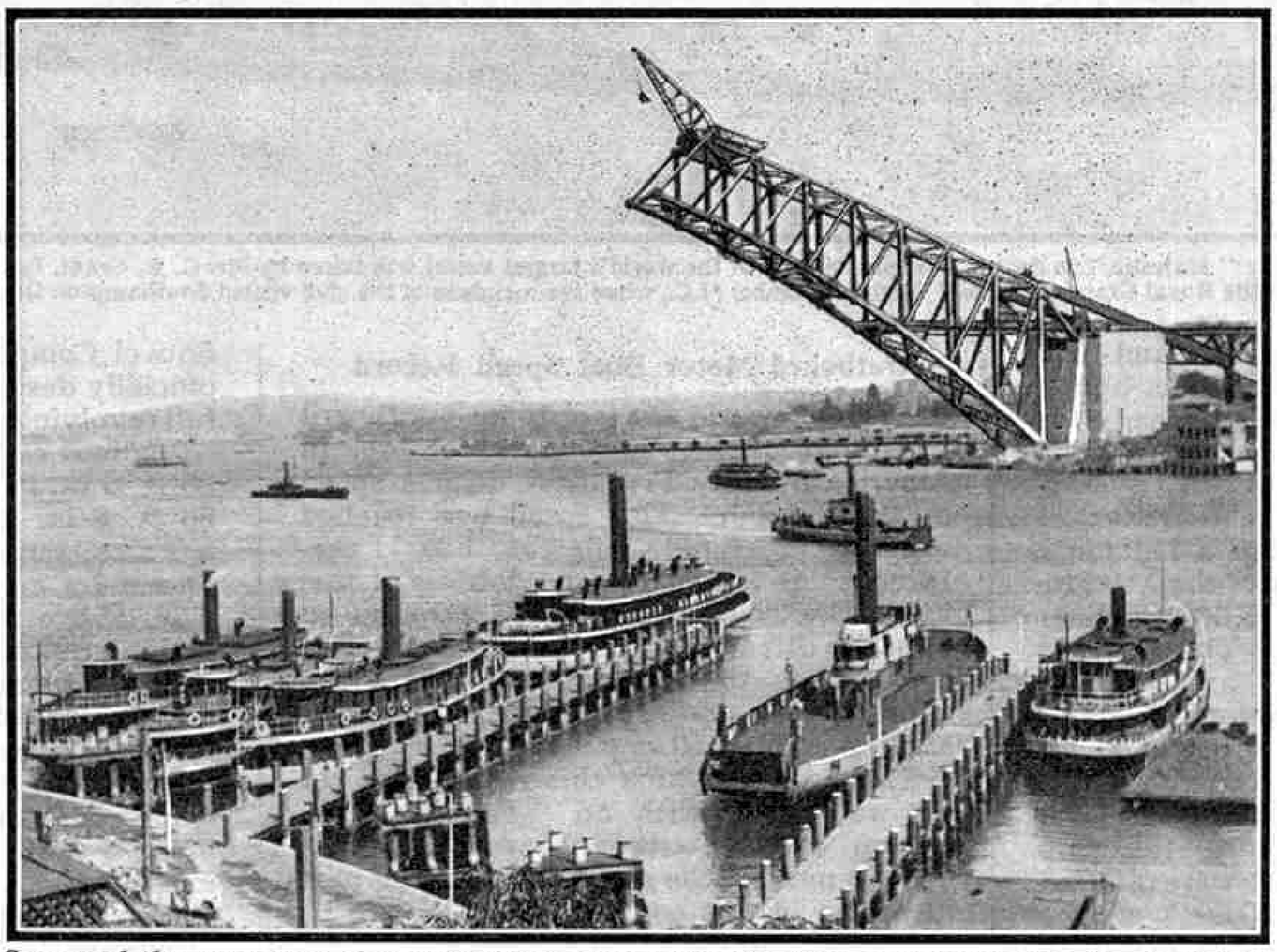
During the past year work has gone on rapidly, and in spite of occasional strikes of workmen for higher wages there is no reason why the great 1,650-ft. steel arch should not be completed in schedule time, that is by the end of 1931. The contract price for the building of the bridge was something under £4,500,000. There is no doubt that this sum will be greatly exceeded, however, for the reason that the cost of material has increased to some extent, while wages have increased to what would be an alarming extent to the contractors but for the fact that, under a covering or safety clause in the contract, all such increases are to be borne by the Government of New South Wales. The contractors pay only the rates that obtained at the date upon which the contract was signed; all subsequent increases are to be borne by the Public Works Department, which is the Government authority carrying out the work. These wage increases amount to as much as 99 per cent. in the case of boilermakers, and 34 per cent. in the shops, where 506 men are employed.



A close-up view of the southern arm of the arch, showing a creeper crane at work. The immense cables used to anchor back the mass of steelwork are shown on the right of the photograph.

While much has been heard in engineering circles of delays and hold-ups caused by the demands of the men for higher wages, there is also another side to the picture. Perhaps the Australian workman is something of a paradox; at any rate, while he certainly has been guilty of many a strike since the bridge construction work started, he has also been "guilty" of establishing a world's record for the quantity of fabricated steel placed in position in a single working day in this class of construction. Working at top pressure a few months ago, men engaged on the structure erected 440 tons of steelwork on the two sections of the great arch between 5 a.m. and 3 p.m. By this effort they beat the former record of 360 tons placed in position on the Hell Gate Bridge, New York, a structure similar to the Sydney Bridge, but with a span of 1,200 ft. as against the 1,650 ft. of the Australian bridge. It is an interesting fact that at the time this record was made Sydney was full of American tourists, who were obviously greatly impressed by the work of the bridge-builders.

In the completed bridge there will be altogether 50,200 tons of steel, the cost of which will be about £3,000,000. This enormous mass of steel will be contained in the five northern approach spans, the main arch span, and the five southern approach spans. All these approach spans have long been completed, and in March last there were already erected eight panels of the main arch span on the southern or city side, and five panels of this span on the northern side. The weight of steel placed in position at that date was approximately 25,920 tons, or about half the total.



Some of the steamers that provide such a splendid ferry service across the harbour. The photograph gives a good idea of the progress made on the southern arm of the arch.

There is an interesting link with the past in connection with the undertaking. In the year 1789, when the French Revolution was sending shudders through Europe, there was being built at Dawes Point a little brick house—the first house ever erected of Australian-made bricks. The house is now no longer there, but there are still to be seen the dark red bricks with the broad arrow upon them signifying that they had been made by Government labour. Set in the base of one of these brick walls is the oldest foundation stone in Australia. It bears the initials of Major Robert Ross, who came out with Governor Phillip in 1787, and who became Lieut.-Governor of the colony. It is almost on the site of this house that the gigantic skewbacks of the southern section of the arch have been constructed. They are of granite concrete, rising out of the sandstone; and the pressure on that sandstone when the arch is locked will be over 15 tons to the sq. ft.

Already in Sydney an animated wordy warfare is being waged as to traffic conditions on the bridge when it is completed. The uninitiated are asking themselves gravely: "Will the structure stand the strain of trains and traffic and storm and wind?" Problems of this kind may safely be left to the engineers, who have studied and allowed for every possible strain and stress before drawing up their specifications. As some indication of the colossal strength of this arch of steel it may be said that there would be a deflection of only 4½ in. with traffic at its full capacity—that is 160 trains and 6,000 vehicles per hour in both directions, and 40,000 passengers walking at the rate of three miles per hour along the footways. In a climate such as that of Sydney, with hot summers and quite cool winters, careful allowance must be made for temperature changes in estimation of stresses and strains. The engineers have calculated that the rises and falls in temperature will effect the total pressure on the arch only to the extent of half per cent.

In Sydney Harbour the rise and fall of the tide is about 5 ft., but nobody need have any fears for shipping. There will be ample space under the bridge at high water to allow the passage of vessels with 172 ft. masts.

It is a curious fact that in 1790 Dr. Erasmus Darwin, grandfather of Charles Darwin, wrote some lines that read to-day like a direct prophecy of the Sydney Harbour Bridge. His lines are:—

"Where Sydney Cove her lucid bosom swells
High on a rock amid the troubled air,
Hope stood sublime . . . . . .
There the proud arch, Colossus-like, bestride
Yon glittering stream, and bound the chasing tide."

To-day we are watching that "proud arch" grow.

Engineering News

The "*Hindenburg*" Refloated

After several unsuccessful attempts, the German battle cruiser "*Hindenburg*," scuttled at Scapa Flow in 1918, has at last been refloated by Cox and Danks Ltd., the salvage engineers in charge of operations. During the preparatory work of salvage upon the vessel, a reinforced concrete block was cast round the port propellers and the port side of the stern of the ship. The purpose of this arrangement was to steady the ship when she was refloated, but when pumping operations were commenced and the vessel began to rise, it was found that she had an alarming list to starboard. The ship therefore was deliberately sunk again, and a similar reinforced concrete block cast round the stern on the starboard side. The pumps were then brought into action again, and after a short pause owing to bad weather, the ship was successfully floated. The "*Hindenburg*" was then towed to Mill Bay, where she was made seaworthy in order to allow her to be towed to the Firth of Forth where she will be broken up.

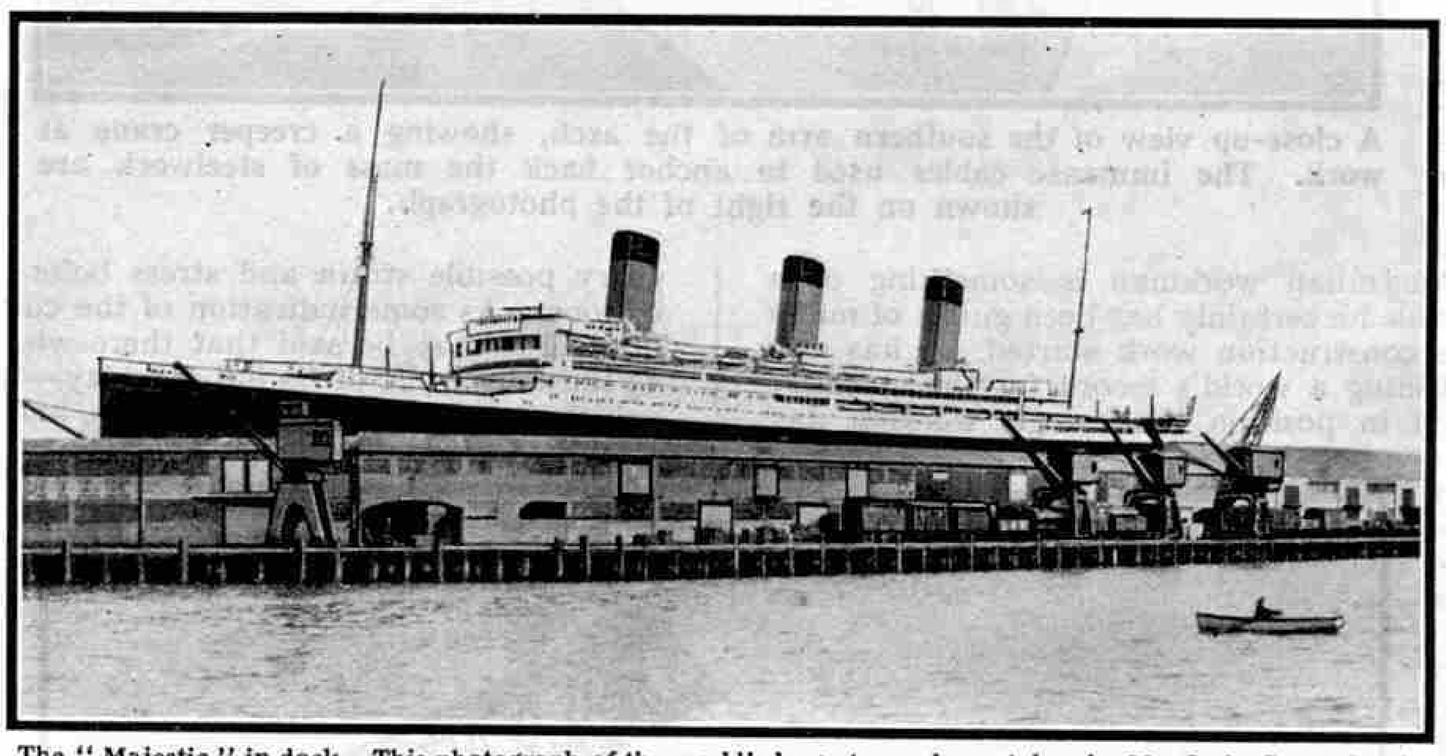
Work is now proceeding on the tasks of raising the "*Von der Tann*," and the "*Prinz Regent Luitpold*," and it is hoped that these vessels shortly will be ready for refloating.

Giant Liner to be Built in Italy

Italy has decided to make a bid for a share in the passenger traffic of the Atlantic and for this purpose a new 45,000-ton liner is now under construction. The vessel is to be named the "*Rex*," and will be equipped with engines developing 90,000 h.p., giving her a cruising speed of about 27 knots. This is slightly lower than the expected cruising speed of the giant liner that is to be built for the Cunard Steamship Company, the plans for which were referred to in the "*Engineering News*" of the "*M.M.*" for August, 1930. The length of the Italian vessel also is stated to be less than that of the British ship, being only 887 ft. The maximum width is about 97 ft., 23 ft. less than the breadth of the projected Cunarder.

The superstructure of the "*Rex*" will have ten decks, six of them stretching along the entire length of the vessel. She will be fitted with a double bottom and 14 watertight compartments, and even if three of the latter were to become completely flooded, the vessel would still remain afloat.

The "*Rex*" will be a luxurious vessel that will almost deserve to be called a self-contained town, for on board there will be a fully equipped theatre, a church, and a garage. Two swimming pools also will be provided, while for the first time in the history of shipbuilding, every cabin will be fitted with a wireless telephone. By this means, passengers will be able to remain in touch with their businesses throughout the journey.



The "Majestic" in dock. This photograph of the world's largest vessel was taken by Mr. G. A. Grant, Leader of the Royal Grammar School (High Wycombe) M.C., when the members of the club visited Southampton Docks.

Outboard Motor Boat Speed Record

A new world's record for outboard speedboat racing has been set up in America by Ray Preganzer, with a speed of 49·72 m.p.h. This speed was reached over a measured mile at Fox Lake, Illinois. As is usual in speed trials of this kind, the course had to be covered in opposite directions, the average of the two runs giving the speed to be taken into account. On one run, Preganzer attained a speed of over 50 m.p.h.

The boat in which this record was set up was fitted with an "*Elto*," a well-known British outboard engine that is used in most of the speed boats taking part in racing in this country.

Liquid for Use in High Voltage Switches

German electrical engineers have introduced a new liquid to replace the customary insulating oil in switches intended for use in circuits carrying currents at pressures of up to 600,000 volts. The nature of the liquid is being kept secret.

As most of our readers are aware, the main reason for putting oil in such switches is to prevent the occurrence of flashes or sparks when contact is being made or broken. It is claimed that the new liquid remains effective for longer periods than oil, and that it possesses better insulating properties. Its use therefore will enable smaller switches to be used for high-voltage work.

The problem of efficient high-voltage switches also has received a considerable amount of attention in the United States, and in one type of switch introduced there a vacuum chamber is used in order to minimise the spark at the points of contact. The switch was designed originally for use in laboratory experiments involving the generation of millions of volts and it is hoped that eventually similar switches will be produced for commercial use.

Canada's Largest Electric Shovel

What is claimed to be the largest electric shovel ever used in Canada recently has been secured by the Beauharnois Power Company, who are using it in work on the site of a new power house now being erected near the St. Lawrence River. The shovel was constructed by the Marion Steam Shovel Company, of Marion, Ohio, and is officially designated a "Type 3520 'Marion' full revolving electric shovel." It is mounted on four railway trucks, and has a boom 93 ft. 6 in. in length, and a bucket handle 60 ft. 6 in. in length. The bucket itself has a capacity of eight cubic yards. At its maximum height of dump, which is 67 ft. 6 in. above top of rail, it has a radius of action of 97 ft. The weight of the machine in full working order is 1,100,000 lb.

Some idea of the extent of the operations carried on by the Company may be obtained from the fact that 2,000 men are employed—and work is carried on 24 hours a day. The equipment used is very extensive. In addition to the electric shovel already mentioned it includes two others with capacities of four and two cubic yards respectively, seven petrol dragline shovels, four steel tower excavators, a hydraulic dredger, 14 locomotives, 90 dump wagons, one rock-crushing plant, and one 26,000-barrel fuel oil tank. At the commencement of operations, 200,000 cubic yards of rock were blasted away during the short time of 46 days. The electric shovels are now at work on the removal of the rock.

Breakwater for Padstow Harbour

A scheme is now being considered for the construction of a sea wall or breakwater across the mouth of Padstow harbour in Cornwall. The wall is needed to replace a natural breakwater, consisting of a large sandbank, that for centuries has protected the harbour, but which is now gradually being carried away by the strong-running tides. This movement is causing the harbour to become unsafe for vessels, for with the flattening of the sandbank, the ground seas are able to enter the harbour at full force and sweep up the River Camel, causing whirlpools in the neighbourhood of the docks and quays. Some idea of the force of the currents set up may be gathered from the fact that on a number of occasions the hawsers of moored vessels have been snapped.

The estimated cost of the proposed scheme is £50,000. It is hoped that the Southern Railway will come to the aid of the Harbour Commissioners, and also that a grant will be made by Parliament.

Padstow is one of the oldest ports in England. It was once of considerable importance and is yet a centre of the fishing industry on the West Coast of Cornwall. It is noted particularly for the excellent catches of sole obtained in the neighbourhood. Shoals of this fish are found so near the land, that very frequently they are on the quay only two hours after having been taken out of the sea. If the money for the artificial breakwater to replace the natural bar is not forthcoming, the port will have to be closed. This will be a great blow to the inhabitants of Padstow, the majority of whom depend upon the fishing industry for their livelihood.

British Canal Improvement Scheme

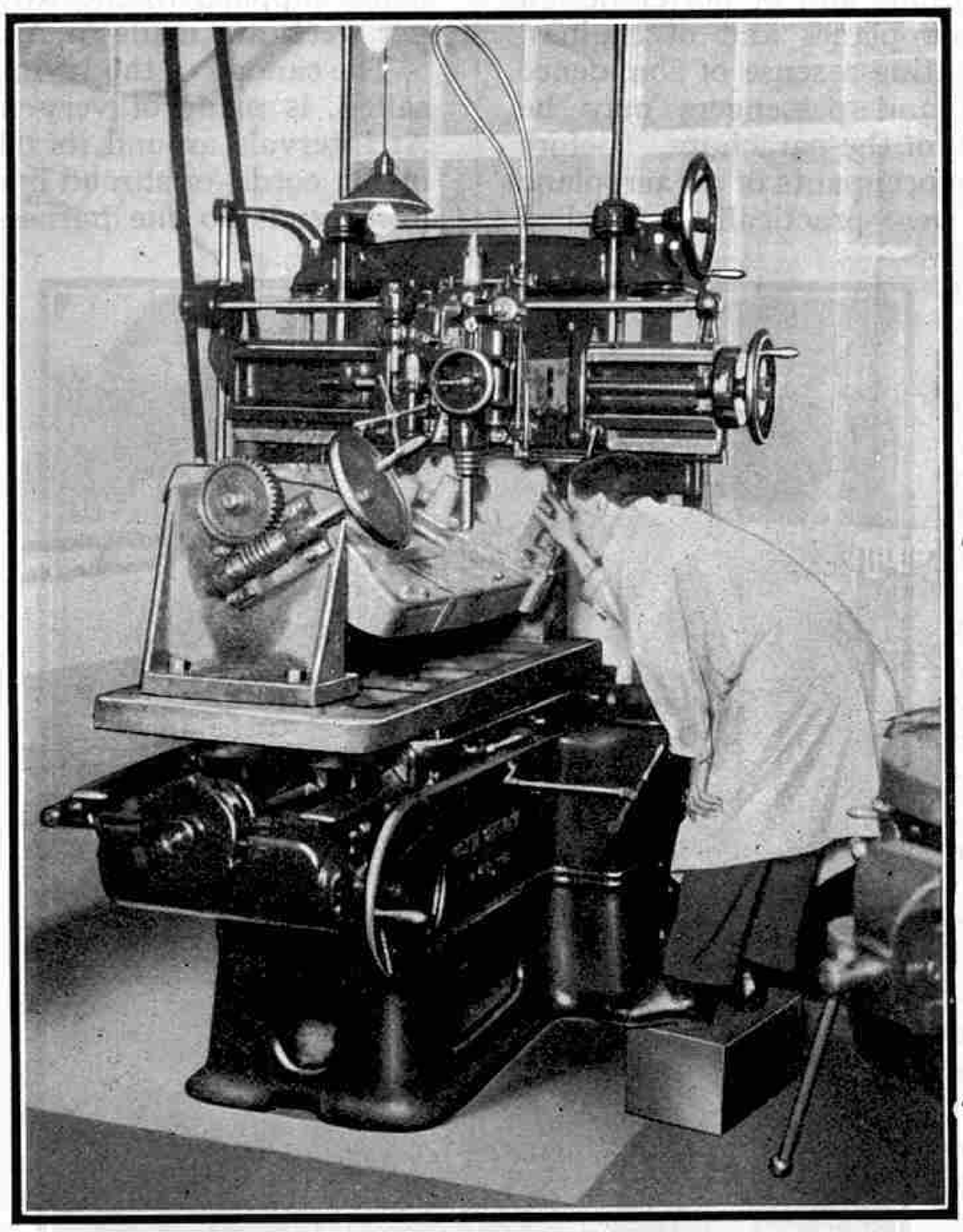
In view of the predominance of railways and roads it is interesting to note that a scheme for the improvement of the London-Birmingham canal is now awaiting the necessary authority from Parliament before being proceeded with. The work already has been provisionally approved by the Government. It is expected to cost £1,031,000, and provides for the reconstruction of locks and bridges, and the erection of a number of pumping stations. Certain sections of the canal also are to be dredged, piles renewed and new concrete walls to be erected. The reconstruction is expected to occupy three years. On its completion a further section of the scheme that provides for the enlargement of certain narrow sections will be proceeded with.

When present plans have been put into operation, craft measuring up to 14 ft. in width will be able to use the whole length of the canal. This will enable cargo shipped on barges on the Thames to be transported direct to its destination without loss of time in transferring it to the narrow boats that at present must be used in order to negotiate narrow stretches of the canal.

Large Power Station in Algeria

A power station that eventually will be the largest in Algeria is now being constructed at Algiers. At first this station will be equipped with five Stirling steam generators, but eventually will be enlarged to double this capacity. The first installation will include four turbo-alternators, two of 12,000 k.w. each, and two others that jointly develop 12,800 k.w., but when in full working order, five more sets, each of 25,000 k.w., will be installed. Distilled sea water will be used in the boilers.

Algeria already possesses 59 power stations, each with a capacity exceeding 91,000 k.w., and it is interesting to note that in addition to this fuel power plant several hydro-electric stations also are projected. Eight barrages have been completed during recent months and work is now to proceed on about twelve more. One of the largest of those recently constructed holds up 230,000,000 c.m. of water.



This wonderful Jig Boring machine, which is shown at work in the Tool Room of the Meccano Factory, holds a world's record for combined speed and accuracy. As a test, seventeen equidistant holes, ¾ in. in diameter, were bored on the circumferances of equal circles on two steel plates 1 in. in thickness, and the plates were afterwards plugged together with hardened steel plugs. It was found that the plates could be plugged in any relative position of the holes about the centre, showing that the accuracy of the machine is as nearly perfect as could be wished for.

Birmingham's New Reservoir

A huge new reservoir, that will have a total capacity of 541,000,000 gallons of water, has now been completed at Birmingham. This will give the city a reserve supply of water sufficient to meet requirements for a period of 14 days.

The reservoir has been under construction for five years. It is two-thirds of a mile in length, and 630 yards in maximum width, and has a water surface 114 acres in area.

Canadian Bridge to Cost £1,520,000

Preliminary survey work has now begun in preparation for building a new bridge across the St. Lawrence River in the neighbourhood of Cornwall, Ontario, which is about 70 miles above Montreal. The necessary authority for the erection of the bridge has been granted by the Canadian Parliament to the Cornwall Bridge Company, a well-known Canadian firm of civil engineers, and it is expected that the total cost of construction will be about £1,520,000.

The north end of the structure probably will be situated at a small place called Flanagan's Point, about four miles east of Cornwall. If this location is definitely decided upon, the south end will be in the Province of Quebec and the bridge will span the river at a point where advantage may be taken of several islands. From the south end of the bridge, it is proposed to build a roadway to the Canada-United States frontier, which is only about two miles away. At the frontier this road would connect with the New York State highways system.

At present the nearest road bridge is the newly completed structure at Montreal, and in the immediate neighbourhood of Cornwall the St. Lawrence can only be crossed by means of ferry boats. The new bridge will obviate the necessity of using these and will greatly facilitate international highway traffic.

Drilling Holes in Submerged Rock

A simple but interesting means of drilling holes in submerged rock has been designed for use at Colombo Harbour, Ceylon. At present the water in the harbour has a depth of only 12 ft. owing to the presence on the bottom of a number of rocky protuberances that are covered by about two feet of sand. When it became desirable to increase the depth it was decided to blast away these bosses. Before this could be done, holes to carry the charges of explosive had to be drilled in the rocks, and it was found that this work presented a certain amount of difficulty, chiefly owing to the turbulence of the water.

A member of the staff of a British firm of engineers examined the conditions under which the drills would have to work, and in conjunction with the local harbour engineers, designed a somewhat unusual rig that is to be employed for drilling the holes. A pipe, 4½ in. in diameter, will be sunk through the water and the sand until it reaches the solid rock. It will then be held upright, either by means of guys or by weighting a large flange at the bottom of the pipe, and at the top a platform for the operator will be clamped. The drill then will be passed down the inside of the pipe, and will be operated in the normal manner.

When the drill has to be lengthened, the bracket carrying the compressed air drilling machine will be moved aside, and the extension secured to the drill.

The Irvin Air Chute

Invention That Has Saved More Than 200 Lives

TO-DAY flying is very much safer than it was 20 or even 10 years ago. This is the result of increased knowledge of air conditions and of better design and construction, both of aeroplanes and of engines, but a very great share in creating a sense of confidence and security among pilots and passengers may be attributed to the introduction of the parachute. Before this came into general use the occupants of an aeroplane that became unmanageable were practically compelled to take part in the crash that followed. When equipped with reliable parachutes they may now step over the side of a disabled aeroplane with far less risk than is taken by a man who jumps from a motor car travelling at a reasonable speed that is about to collide with some obstacle. One important condition must be fulfilled, however—they must abandon the aeroplane at a sufficient height above the ground to give the parachute an opportunity to open.

The parachute is not a new thing. For many years before Orville Wright achieved the first flight in a heavier-than-air machine parachute descents from balloons were made as entertainments. These were carried out only when conditions were favourable and even then fatal accidents occasionally took place, the cause usually being that the parachute failed to open.

Since the moment for a descent from a disabled aeroplane cannot be chosen, more efficient parachutes than those used in such exhibitions were necessary in order to enable emergency landings to be made with a good prospect of avoiding injury. Many inventors tackled the problem of producing a really reliable parachute and one of the earliest and most successful of these was Mr. Leslie Irvin, the originator of the form of parachute now used by the Royal Air Force and the American Air Services. Mr. Irvin began his experiments more than 20 years ago, and his amazingly risky trials of the parachutes he constructed led to his being given the name "Sky-Hi Irvin." Every idea for improving the crude parachutes was put to a practical test, and with every jump Irvin learned something new. The result is that he developed a form of parachute that is quite reliable and is used throughout the world in greater numbers than any other type. At the present moment about 40 Irvin parachutes are produced weekly in the British factory of the company that manufactures them, most of these being supplied to the Royal Air Force, and nearly 100 per week are made in America.

The canopy of the Irvin Air Chute, as this parachute is called, is made of very fine but strong Japanese silk. At intervals around its edges are sewn a large number of silk cords, or shroud lines, that are connected at their lower ends to the harness worn by the airman. The parachute itself is not single, for attached to it by means of a short silk cord is a small pilot chute, 30 in. in diameter, that is used for the purpose of pulling out the main folds of the parachute.

Photographs showing the harness by means of which the airman is suspended from the Irvin Air Chute. It is simply attached by means of three hooks. The sides of the pack spring open, and the parachute is released, when the ring on his left side is pulled.

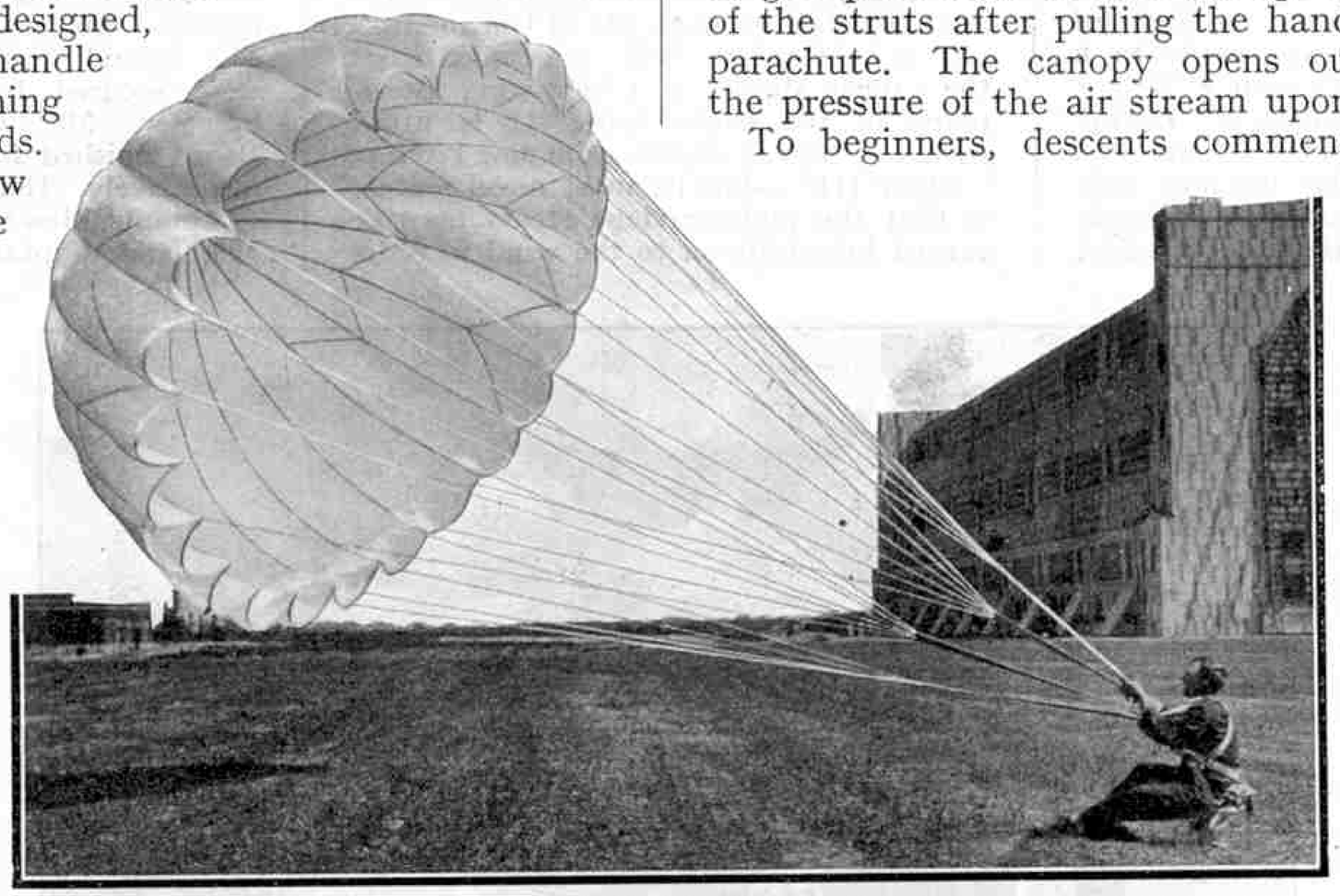
In order to prepare the Irvin Chute for use it is carefully folded, the pilot parachute being uppermost, and placed inside a canvas pack. The sides of the pack are then folded over. This requires the exertion of a certain amount of force, for strong rubber bands offer resistance, and when the pack is closed two pins are inserted in order to hold it together.

The pack containing the parachute is fastened to the harness that is worn by the airman. This harness is easily slipped on and is securely held in position by means of three hooks. Equipped with it an airman is ready for all emergencies. The pack is quite out of his way, for it hangs so low down at the back that it forms a cushion on which he sits.

In order to follow the action of the Irvin Air Chute let us suppose that a pilot equipped with one finds it necessary to leave an aeroplane. Climbing out of the cockpit he simply lets go his hold of the machine and drops into space. His body takes up an almost horizontal position and turns over and over as he falls with increasing speed. Suddenly a flash of white appears. This is the pilot chute. The rush of air opens it out and causes it to drag after it a larger white object, which is the canopy of the main chute. As the air finds its way under this, the silk cords attached to the harness are spread out to their full length. The resistance of the air to the movement of the fully opened parachute arrests the earthward plunge of the airman, and instead of falling with ever increasing speed he floats gently downward.

How has the airman brought his parachute into action? To open it while in the aeroplane could only lead to disaster, for the canopy would immediately become entangled with the fuselage or wings. For this reason a pilot using a parachute always counts ten before releasing it from the pack. In that time he acquires considerable speed, however, and it is quite clear that the action of releasing the parachute must be made as simple as possible. This has not been overlooked in designing the Irvin Air Chute, and pulling a handle strapped at the side of the airman is sufficient to open it out. This handle is connected by cables to the pins that keep the pack closed. Immediately it is pulled, therefore, the pins are extracted, and the pack opens, the rubber bands on its sides causing these to spring apart. The pilot chute first emerges and the canopy of the main chute follows. So neatly are the two packed, and so carefully is the parachute designed, that from pulling the handle to the complete opening takes only 1 3/5 seconds.

Even during the few seconds before the parachute opens the descending airman has the feeling that he is floating in a stationary position, and when his fall is checked by the opening of the canopy he is readily deluded into the belief that he is at rest in the air while the earth is rising slowly to meet him. The rate of descent of the general service Irvin Air Chute, which has a diameter of 24 ft., is only 21 ft. per second, and the landing is about equivalent to jumping from a 10 ft. wall. It is even possible to choose a landing place, for by pulling at a group of shroud lines a section of the canopy may be crumpled and the airman then swings towards the opposite side. Practised "chuters" become quite accustomed to steering themselves to a certain extent in this manner and make use of it in avoiding trees and other obstacles.



The Irvin Air Chute brings an airman safely to the ground. The silk cords connected to the airman's harness pass right round the canopy.

Although demonstrations have shown time after time that descents by parachutes are perfectly safe, the first drop from an aeroplane through space must have some terrors for practically every aspirant. In order to reduce the severity of the ordeal a special training chute that descends more slowly than the general service type is made. This has a diameter of 28 ft., and falls at the rate of 16 ft. per second.

Other types also are manufactured. For instance, one of 22 ft. diameter is specially designed to be worn on the chest at the same time as the 28 ft. type. In training work novices commonly use both types in order to give confidence.

When in the air an airman must always wear his pack, for it must be ready to hand in any emergency. Irvin Air Chutes therefore are placed in containers of several different forms, each of which is adapted to some special purpose. The type of pack that forms a cushion is chiefly used by pilots of aeroplanes, who must retain freedom to move their limbs. Aerial photographers and observers usually have more room at their disposal than pilots, and for them packs have been designed to be attached to the front of the harness, and to rest on their knees during flight. A third type of pack is made to suit the requirements of members of the crew of a balloon or airship. These move about during a flight and therefore the packs containing their parachutes are strapped high up on their backs in order to be quite out of the way until the moment for their use actually arrives.

An interesting variation of the usual methods of making parachute descents often is employed. In this the airman allows himself to be pulled from a machine in flight by the parachute. In order to make a descent in this manner he usually walks along the wing in order to get quite clear of the fuselage and holds on to one of the struts after pulling the handle that releases the parachute. The canopy opens out behind him and the pressure of the air stream upon it pulls him away.

To beginners, descents commenced in this manner are less nerve racking than those in which they are compelled to step over the side of an aeroplane. The parachute acts from the moment of letting go and the preliminary drop is omitted. For this reason the method is largely used in the early stages of training. Those who witnessed the display given by the Royal Air Force at Hendon last year will be familiar with it, for it was used to enable six men to make a simultaneous descent. One of these stood on each of the six lower wings of three biplanes and let go at a given signal.

A new "Quick Connecter" type of Irvin parachute is now available. This is designed to be hung in the cabin of a passenger aeroplane or airship in much the same manner as a lifebelt is placed in a ship's cabin. When required it may be hooked on to the harness at two points and even if only one connection is made the parachute will act perfectly.

In emergencies it is seldom possible to do anything beyond getting clear of the aeroplane as quickly as possible. Parachute descents form a part of the training of practically every airman, however. For instance, in the British Royal Air Force, in which the Irvin Air Chute is officially used, no pilot or observer is allowed to enter a machine unless he is wearing his parachute.

Thus to the modern airman the prospect of having to reach the ground by parachute presents no terrors, and the lives of many aviators have been saved by the prompt use of this essential part of their equipment. The Irvin Air Chute itself has been the means of saving more than 200 airmen from death or serious injury.

For the illustrations to this article, and also for assistance in its preparation, we are indebted to the Irvin Air Chute of Great Britain Ltd.

World's Longest Flight

In our last issue we gave brief details of a new world's re-fuelled endurance record made in America. According to further details now available, the flight of 533 hours 41½ minutes was made in a Stinson machine equipped with a Wright "J.6" engine developing 300 h.p. During the flight a distance of 40,000 miles was covered non-stop. If the machine had been flown in one direction only, it would have encircled the earth and have travelled more than half way round again! In the absence of refuelling facilities such a flight is at present impossible, of course.

The history of the aeroplane with which the feat was accomplished is very remarkable. It is by no means new, and in fact, already had been flown 30,000 miles in the service of a commercial air transport company. It also had been used in two re-fuelled endurance flights, the total flying time for which was over 500 hours. For the last eight months prior to the record-making effort the machine had been used for private flying.

The Wright engine also is not new, for it was installed in the machine before one of the endurance flights, when it was flown non-stop for 300 hours. The same engine was used during the eight month's private flying carried out on the machine.

It is interesting to note that during the Stinson machine's record-making flight, the crankshaft of the engine made 52,000,000 revolutions, while each valve opened and closed 26,000,000 times. Each piston travelled a distance of 9,025 miles, which represents 104,000,000 strokes, and the number of revolutions of the supercharger was no less than 405,600,000.

Scarcely had this record been made when it was broken. Two former holders of the record, named Jackson and O'Brien, determined to make an effort to regain their lost laurels and in a machine equipped with a 170 h.p. Challenger engine they remained in the air above St. Louis, Missouri, for a period of no less than 647 hours 28 minutes. The two airmen had expressed their intention of making a flight of 1,000 hours duration but were prevented from doing so by engine failure.

Prince of Wales Buys a "Puss Moth"

It is interesting to learn that the Prince of Wales has purchased a de Havilland "Puss Moth" similar to the one illustrated and described on page 521 of last month's "*M.M.*" Readers will remember that the "Puss Moth" is a high-wing monoplane of the cabin type. It is fitted with an inverted engine—the new 120 h.p. "Gipsy III"—but its most novel feature is that the undercarriage struts may be turned broadside-on to the wind in order to act as air brakes and thus to increase the gliding angle of the machine. A machine of this type was shown in the park for new and experimental machines at the recent R.A.F. Display at Hendon.

The Prince's machine has the lettering G-ABBS. It has been fitted with two wing fuel tanks, giving a petrol capacity of 35 gallons, and a cruising range of 735 miles. The aeroplane is of the standard type except in regard to its colour. The upper part of the fuselage and the engine cowling are coloured blue, while red has been chosen for the lower portion of the fuselage, the two colours being separated by a narrow silver line.

Wings, ailerons, elevators and tail plane are coloured silver, while two vertical blue stripes separated by a red one distinguish the rudder. The registration letters will be painted on the fuselage and wings in silver and blue respectively.

R.A.F. apprentices studying the instrument board of a military machine.

The Challenge de Tourisme International

The Challenge de Tourisme International was this year won by Herr Morzik, a well-known German aviator, who thus repeated his success in the 1929 event. The second, third, and fifth places also were secured by Germans, while Miss Spooner, Mr. Carberry, and Captain Broad finished fourth, sixth and seventh, respectively. Herr Morzik gained a total of 423 points, Miss Spooner 416, Mr. Carberry 405, and Captain Broad 395. Captain Broad's score is somewhat surprising, for he led the field during the actual race, and was the first man home. But for failing to secure full points in certain technical tests, Captain Broad undoubtedly would have won the prize, for he maintained first place in the table of results until very near the final day.

The Challenge de Tourisme International is flown round Europe, and concludes with an examination of the machines and tests of their capabilities in technical trials. This year the flight started from Berlin, and the course took the competitors to important aerodromes in France, England, Spain, Switzerland, Austria-Hungary, Czecho-Slovakia, Poland, and Danzig. This is the first time in the history of the Contest that the machines have passed over England.

The total number of entries was 97. Of these 47 were German, 16 French, 14 Polish, nine Spanish, seven British, and four came from Switzerland. It speaks well for the British entrants that out of such a large field, they secured three of the first seven places. In addition Captain Broad distinguished himself by securing full marks in the speed and reliability sections of the contest. The only other competitor to do so was Mr. A. S. Butler, another British entrant, these two airmen being the first to complete the circuit. Unfortunately Mr. Butler was disqualified because an accident at an aerodrome made it necessary to fit a new propeller that he had not carried with him throughout the flight. The leading British competitor was Miss Spooner, with 416 marks out of a possible total of 500.

Aerial Manœuvres. A flight of single-seater interceptor fighters awaiting the signal to attack a marauding enemy squadron.

"*R100's*" Atlantic Crossing

A flight across the Atlantic Ocean has been made in record time by the British airship "*R100*," with 44 persons on board. The trip was made between Cardington and St. Hubert, Montreal. The course followed was 3,364 miles in length and this was completed in exactly 79 hours. The journey was quite uneventful, except that a portion of the fabric near the fin was torn by the wind shortly before the airship arrived at its destination. When the vessel left Cardington she had on board 10,444 gallons of petrol, and of this, she used 8,940 gallons.

The "*R100*" is equipped for long wave wireless transmission, and for long and short wave reception, and thus was able to keep in touch with either Cardington or the St. Hubert air station during the whole of her flight. She was also able to receive meteorological reports while in flight, and from the information secured by wireless, special weather charts were drawn every six hours by the meteorological officer on board.

The value of this arrangement was clearly shown when "*R100's*" course was changed on account of information received over the wireless and included on the weather maps. It had been the original intention for the vessel to follow a somewhat northerly course, where, immediately before the flight commenced, the winds were favourable. But the eastward movement of a low pressure area caused changes in the direction of the winds. Immediately information of this was received by the navigating officers, the ship was put on a more southerly course in order to take advantage of the better conditions thus obtained.

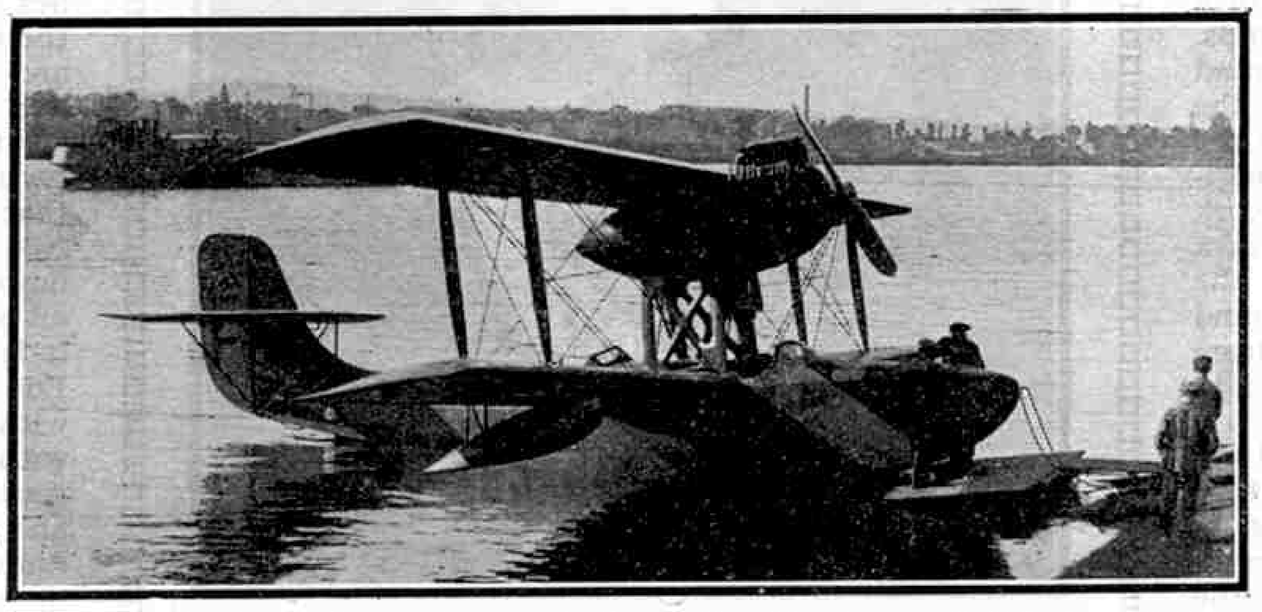
Arrangements also were made for a number of interesting experiments to be carried out during the flight. These consisted of the exposure outside the control cabin of small flat glass dishes containing a preparation of agar-agar. This is a vegetable gum obtained from sea-weeds, and is extensively used in the East in the preparation of soups and jellies. It is particularly relished by bacteria and one of these introduced into it quickly develops into a colony.

During the flight of "*R100*" the "Petri" dishes, as those containing the jelly are called, were exposed at intervals of three hours. Any traces of vegetable organisms and minute living spores present in the air over the Atlantic were thus given an opportunity of revealing themselves by settling upon the dishes and commencing growth. On the arrival of the airship in Canada, the dishes were sent back to England for examination at the Cambridge School of Agriculture. It is hoped that the experiment will throw light upon a number of outstanding problems in the botanical world.

The return flight of "*R100*" was even more interesting in character than the westward crossing, for although one engine was out of action, the long journey of 3,300 miles from Montreal to Cardington was made in the remarkably short time of 57 hours. On the eastward flight the vessel ran into a violent storm that probably would have been fatal to the hopes of any one trying to make the flight in an aeroplane. Her behaviour under these trying conditions was excellent. Many of the passengers slept during her passage through the storm, and on wakening to find a blue sky and a placid ocean were astonished to learn that a violent storm had raged throughout the night.

Practically the only unpleasant result of the stormy weather encountered was the flooding of the kitchen by water that forced its way through the fabric. The cover of the airship is now two years old and it is to be replaced.

It is interesting to note that the flight of the British vessel was the 24th crossing of the Atlantic to be made by air. Of these trans-Atlantic flights, 13 have been made in airships, and 11 in heavier-than-air machines.



A flying boat on the water at Argenteuil. Machines of this type have been much used on French air mail routes.

The England-India Air Route

A further step in the direction of an all-air service between London and Karachi was made a short time ago when arrangements were made for the section between Skoplje, in Jugo-Slavia, and Salonica to be operated by air in place of the night train in which travellers formerly have traversed this part of the journey. This latest arrangement means that with the exception of the short section between Alexandria and Cairo, the whole of the England-India service is now operated by air.

A record India-England flight was made a short time ago by Imperial Airways, when the Indian mail was delivered at Croydon 5¾ days after being enplaned at Karachi. This flight beats by several hours the previous record, which was held by Miss Amy Johnson, and it is interesting to note that it was made over a longer route than that followed on the latter's famous journey to Australia.

Tiny Airship Meets Atlantic Liner

An interesting ship-to-shore flight was made recently, when a passenger was taken off the "*Bremen*" by a Goodyear blimp airship as the famous liner approached the American shore. The airship flew over the "*Bremen*" immediately she arrived at the quarantine station. Men on board the German vessel then caught a rope trailing from the blimp, by means of which the airship was pulled down until the passenger could step aboard, in readiness to be flown to the aerodrome on Long Island.

This is an entirely new departure in ship-to-shore flights. Small airships of the blimp type have much to commend them for work of this kind. They are non-rigid vessels, and are much smaller and handier than giant rigid airships such as "*R100*," the capacity of the envelope of the largest of the Goodyear fleet of blimps being 178,000 c. ft., while that of the smallest is only 54,000 c. ft.

In previous experiments of this type, aeroplanes have been used. In comparison with these, blimps have the advantages that the liner need not be stopped, nor is the use of a long and ungainly runway necessary. In addition the degree of comfort in an airship is greater than in an aeroplane.

XI.—OIL ENGINEERING

OIL was known and used many centuries ago, long before the existence of coal was dreamed of. In certain districts it readily finds its way to the surface, notably in the oil-bearing districts in the Caucasus, where probably it fed the mysterious flames that were venerated by the fire worshippers of pagan times. It is only in comparatively recent times—less than 100 years—that oil has become a factor of importance in industry. To-day it threatens to displace coal from the premier position it has held so long.

As a fuel or an illuminant oil did not become of real importance until the middle years of last century, when James Young, a Scottish industrial chemist living in Manchester, succeeded in distilling from a crude petroleum found in a Derbyshire coal mine paraffin of a quality suitable for use in lamps. The news of this discovery spread to America, where took place the first step in the development of the oil industry. Among the Americans interested in Young's work was a Colonel Drake who sank a bore hole into the earth in the hope of tapping the underground store of petroleum which, from surface indications, he believed to exist in Pennsylvania.

In 1859 Drake succeeded in finding oil, and the scenes that followed can only be compared to those that occur in a gold rush. In the excitement produced by the reports of the tapping of a new source of wealth, men spent their entire resources on the purchase, at exorbitant prices, of small patches of land and of the necessary drilling equipment. Some were successful; others were deluded into the belief that they had "struck oil," only to find that their wells quickly petered out; thousands of others spent all they had without ever discovering the precious fluid. Then came the inevitable reaction, and the Pennsylvania townships that had sprung suddenly into prosperity—Wild Cat Hill, Bonanza Flat, Red Hot, Petroleum Centre—declined rapidly and soon became derelict.

The story of the gold and silver rushes was then repeated. The crude and wasteful methods of the prospectors were replaced by operations on scientific and economic lines under the guidance of skilled geologists and engineers. Trial borings and experiments soon showed that there were vast underground stores of oil, and in a surprisingly short time the petroleum mining industry became established and attained huge proportions. In some places the oil was acquired without much difficulty; elsewhere long and costly efforts were necessary before the subterranean reservoirs could be tapped. Steady and persevering work overcame all difficulties, however, and to-day thousands of men are employed in various activities in oil fields in all parts of the world.

When an oil field has been located by the surveyors and prospectors the drillers follow and erect their derricks and prepare the heavy drilling mechanism that is to descend to a depth perhaps thousands of feet. As the depth of the bore increases a casing is fitted into it, and at last, if the prospectors have read the signs aright, the bit bursts through the rock covering of the dome in which lies the oil-bearing sand. There the oil exists under great pressure, and as soon as this is released by the arrival of the boring tool a column of petroleum rushes violently upward, often with such force that it spouts high into the air. Not all oil wells are "gushers," however. In many instances the oil oozes lazily to the surface, and it is necessary to quicken its rise. For this purpose a cylinder loaded with nitro-glycerine and provided with a detonating cap is lowered gently to the bottom of the bore, and a heavy block of cast iron, known as a "go-devil" is dropped upon it. This projectile strikes the detonator, and thus causes the nitro-glycerine to explode. A muffled roar is heard at the surface, and this is followed by a rush of oil, often accompanied by fragments of rock. As a general rule such an outburst subsides quickly, and then it is found that the oil is rising slowly but steadily. Similar steps are taken if at a later stage a well becomes sluggish.

It is necessary to provide means of storage for the oil that is brought to the surface, and for this purpose tanks of enormous size are erected. As a rule refining of the oil is not carried on at the wells, and therefore it is necessary to arrange for the transport of the oil. The modern method is to conduct it from the well head through pipelines which, in some cases extend over many miles of wild and barren country before reaching a port. There the oil is taken on board specially-built vessels known as "tankers" and conveyed overseas to the refineries. The final stages consist of washing and purifying the oil and breaking it up by distillation into various grades ranging from

FAMOUS ENGINEERS—11

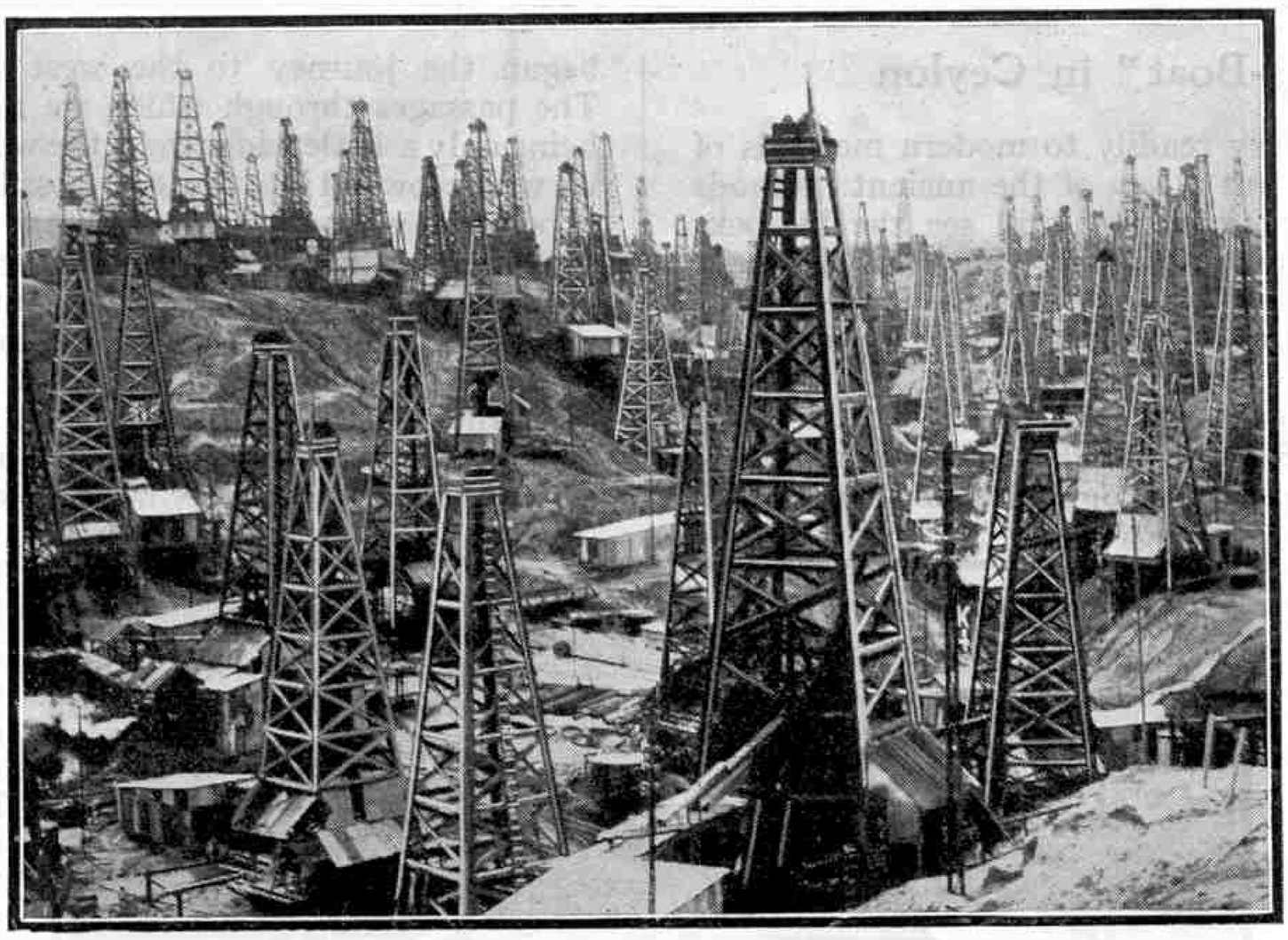
Dr. A. E. Dunstan is President of the Institution of Petroleum Technologists. On the completion of his University career he took up chemical teaching and research work, and for several years prior to 1914 was head of the Science Department of the East London Technical College. During the War he was employed by the Government in the study of chemical problems.

Dr. Dunstan is interested chiefly in the chemical side of the oil industry and occupies the responsible post of Chief Chemist of the Anglo-Persian Oil Co. Ltd. In the research laboratories under his control nearly 100 fully qualified chemists are employed, in addition to a larger number of junior assistants.

light, dry cleaning spirit to petrol, paraffin, and lubricating oils.

Oil technology closely resembles that of mining. At first glance there does not appear to be anything in common between the two, but actually the only difference is that in one case the product is a liquid that finds its own way to the surface, and in the other it is coal or metallic ores that are solid and therefore must be dug out of the earth and raised by hoisting machinery. The men who prospect for oil and those who carry out the actual drilling operations must have as sound a knowledge of the earth's crust as mining engineers, and thus the study of geology and surveying is an essential part of their education. The design and operation of the machinery by means of which wells are bored, and the construction of storage tanks and pipe lines both call for engineering skill and knowledge. It is not surprising therefore to find that the oil technologist receives his training in the Mining Department of a University, or in a well-equipped Mining School.

A good example of the courses of training followed in these institutions is that of the Royal School of Mines, a branch of the Imperial College of Science and Technology, South Kensington, London. The full course occupies five years and is designed to enable students to secure the Associateship of the Royal School of Mines (A.R.S.M.), or the higher diploma of the Imperial College of Science and Technology (D.I.S.). The work is of such a character that students who have passed through the course also should be capable of obtaining the external degree of B.Sc. in Oil Technology of the University of London.



A typical scene in an oil field. The derricks are those of the Burma Corporation at Yenangyoung, on the River Irrawaddy.

During the first and second years of their training students at this institution who intend to specialise in oil engineering take practically the same course as that followed by those who are qualifying as mining engineers. This ensures that they receive a thorough grounding in fundamental sciences, such as chemistry, physics, applied electricity, geology and surveying. Not until the third year does any specialisation take place, and in the final years of the course the future oil engineers take up field work, geological surveying, oil testing and refining, and of course, due attention also is given to drilling and development work.

An important feature of the course followed at the Royal School of Mines, and indeed at all recognised institutions, is that students are given opportunities of gaining practical experience. The regulations of the Royal School of Mines itself demand that at least 720 hours should be spent in this manner, working in shifts of not less than 6 hours. One half of this time must be spent on an oil field. Of the rest, two months are devoted to independent geological surveying, and the remaining time is occupied in drilling work or in coal or oil shale mining.

It will be seen that the whole course, both theoretical and practical, is very comprehensive. It fits those who follow it for positions in any branch of oil engineering, and in addition, it gives them the scientific knowledge necessary to cope with new circumstances and to deal with situations demanding initiative and originality.

Similar courses are arranged at certain British Universities.

Evening courses in oil technology are held at the Sir John Cass Technical Institute, London. They are arranged chiefly for the convenience of those engaged on the commercial side of the oil industry. to whom a theoretical knowledge of mining engineering is extremely useful and well worth acquiring, although practical experience is not necessary. Full information in regard to these courses may be obtained from the Secretary, Sir John Cass, Technical Institute, Jewry St., Aldgate, London, E.C.

After successfully completing a training course, and taking the appropriate degrees or diplomas as evidence of the thoroughness of his preparation for his chosen career, the oil engineer may take up work in one of several interesting branches of the profession. These may be roughly divided into two classes—occupations concerned with wells and refineries already established, and those in which the preliminary explorations and the development of new fields are undertaken.

Of these two, development work is perhaps the more interesting, and certainly it will make the greater appeal to the young man of an adventurous and ambitious type who is willing to seek fortune at the risk of gaining only experience. The oil prospector must have a thorough knowledge of geology in order that he may be able to read in the rocks signs of the presence of oil and to judge whether trial borings are likely to be productive. He must also be capable of carrying out the preliminary work necessary for the extraction of oil, and of developing to the production stage any discovery that may result from his prospecting work.

Work in an already established oil field is of a different type, and to a certain extent may be regarded as routine in character. Productive wells must be kept in order; the pipe line through which the oil is conveyed to the refineries, or to the tankers that carry it overseas, must be maintained in good condition; and general work on the extraction and delivery of the oil must be kept going smoothly and efficiently. But an eye also must be kept on the future. Oil wells may run dry, and in order to exploit a field to the utmost others often must be sunk. In addition, the oil engineer must always be prepared for some freak of nature, for naturally it is impossible to know with certainty what is happening at the bottom of a narrow bore that penetrates the earth to a depth of several thousand feet. Fire also is a danger to be guarded against. Thus even the work of production may be quite as exciting as prospecting, and at any moment the engineer in charge of an established oil field may find himself involved in a gigantic struggle with nature.

Whether he is attracted to prospecting work, or content to employ his skill and knowledge in established oil fields, the oil engineer almost certainly must travel overseas, for so far no extensive reservoirs of oil appear to have been discovered underground in Great Britain. The nearest approach to anything of this nature is the shale that is dug out of the earth in Scotland. This is a black slaty material that is mined in almost exactly the same manner as coal, and on distillation it gives an oil that closely resembles petroleum. It is more costly to produce oil in this manner than to obtain it from oil wells, and only in a few places can shale oil mining be carried on economically.

Another direction in which a qualified oil technologist may find occupation without going overseas is in refining. The technologist who seeks employment in an oil refinery must be well qualified in chemistry in order that he may follow and check the distillation and purification of the oil, and also take part in the work that is undertaken in the laboratories of the great oil companies.

No oil mining engineering student should fail to qualify for membership of one of the grades of the Institution of Petroleum Technologists. The Institution is of comparatively recent growth, for it was founded in 1914 by the late Sir Boverton Redwood and others interested in the petroleum industry, as a means of bringing into contact the engineers, geologists, chemists and others engaged in its several branches. The Institution is international, and at present has a membership of 1,225. There are five distinct grades of membership. These include students and associates in addition to ordinary and associate members, and the future oil engineer who joins as a student is sure to derive benefit from his connection with the experienced and successful men of his profession. Full information regarding the Institution may be obtained from the Secretary, Institution of Petroleum Technologists, Aldine House, Bedford Street, Strand, London, W.C.2.

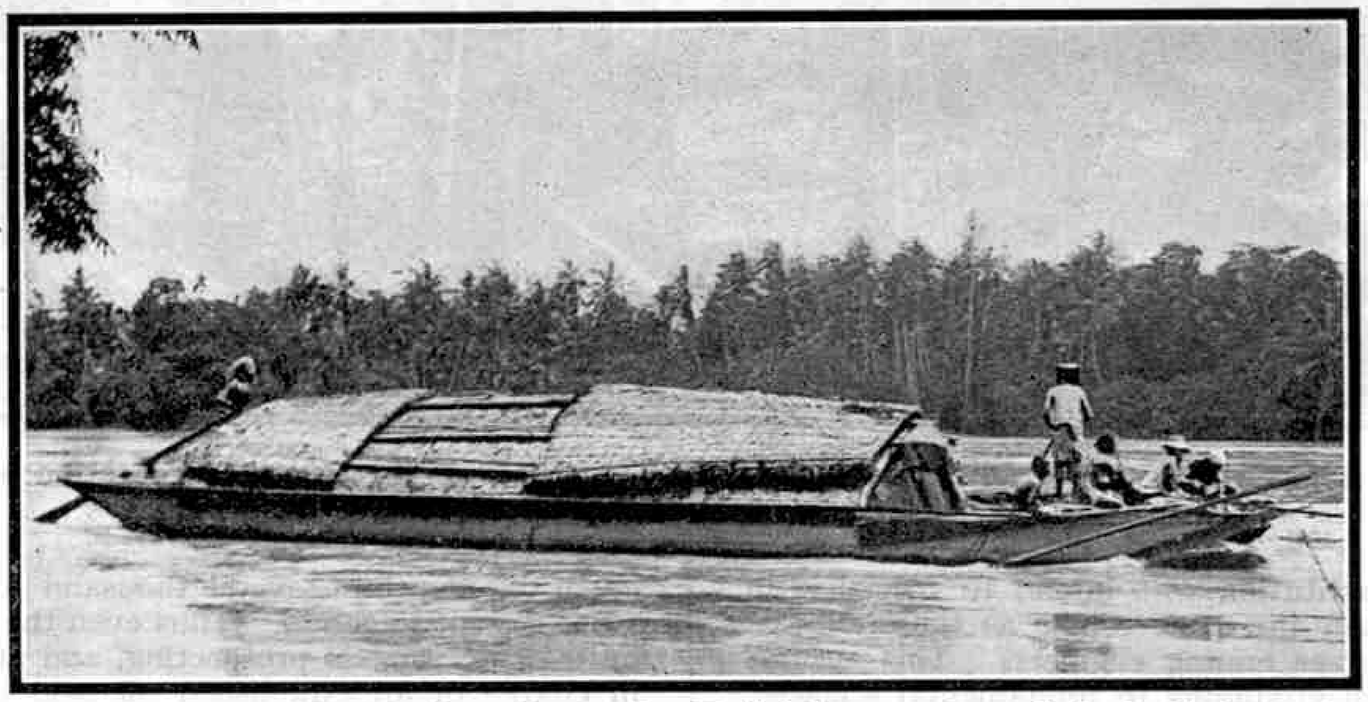
FROM OUR READERS

These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

A "Padda-Boat" in Ceylon

Ceylon has taken very readily to modern methods of travel and transport, but a few of the ancient methods survive. For instance, one may still see the bullock-cart, upon which the passing of time has wrought little change.

An interesting primitive method of transport by water is by means of the "padda-boat." This is a flat-bottomed boat measuring between 25 ft. and 30 ft. in length and about 6 ft. in breadth. It is fairly deep, and has an arch-shaped roofing consisting of a framework of cane and bamboo, covered with the leaves of the coconut palm, which are first interwoven. The roofing at the extremities can be pushed over the central portion, which is fixed, and beneath it the cargo is situated. The boat is propelled by man-power, half-a-dozen villagers pushing it along by turns with long poles that reach the bed of the river. In the intervals between spells of poling they rest or prepare meals. These men are a hardy lot and spend most of their time on the boat.



Heavily-laden "Padda-Boat" on the Kelini-Ganga, one of Ceylon's longest rivers. The boats are pushed along by means of long poles.

The cargo generally consists of estate produce such as tea, rubber, copra and fibre, and sometimes bricks, tiles and earthenware. Many rivers and canals pass through the estates and fields, and it is a simple matter to arrange for the produce to be transported by padda-boat, whereas a railway station may be too far away, and lorry transport by land too costly. The accompanying photograph shows a padda-boat slipping quietly past the palm-fringed bank of the Kelini-Ganga, one of Ceylon's longest rivers.

W. FLANDERKA (Colombo, Ceylon).

Down a Lead Mine

Recently I had the privilege of descending the Allanhead Lead Mine in Northumberland. Going down the shaft of the mine was like descending a well. At a depth of 42 fathoms the cage came to a standstill and we got out to find ourselves in a narrow gallery. Along this ran lines for the wagons in which the lead ore is brought to the bottom of the shaft.

Climbing into one of the wagons after being supplied with lighted candles stuck on lumps of clay we then began the journey to the west end of the working. The passages through which we ran were very narrow, being only a little wider than the wagons, and we felt as if we were crowded into the least possible space. By painful experience we soon discovered that the best way to avoid bruising our heads on the limestone roof, which was perilously near, was to sit still, but in dodging the rock we soon became as expert as our mining guide.

After an uncomfortable ride of about a mile and a half, the wagon stopped and we got out in order to traverse the remaining distance on foot. As we passed along the narrow gallery we noticed that in places the vein of galena, or lead ore, was several inches in thickness and in others it thinned down so gradually that there only remained a thin black line, known to the miners as "slickensides." We saw several veins of fluor-spar, intersected with streaks of glittering galena, and in places cavities full of crystals were visible. In the dim candle-light these shone brilliantly in comparison with the darker walls of the gallery.

As we neared the workings the journey became more arduous. At times we crawled on our hands and knees and at others we climbed or descended perpendicular ladders. Occasionally we found it necessary to worm our way through openings so narrow that in them we should have stuck if we had been a little broader.

Finally we reached the place where the ore was being extracted. There the heat and closeness were very oppressive and we were not surprised to find that the miners stripped to the waist in order to carry on their work. The visit was very enjoyable and we were greatly interested in everything that we saw underground, but we emerged into the light and fresh air with feelings of relief.

Lead has been mined in England for many centuries. Other places where the metal has been extracted are in Derbyshire and at Greenhow, near Pateley Bridge in Yorkshire. Pigs of lead stamped with Imperial marks have been discovered near the latter place, and from the dates on these it is quite clear that the Romans worked the mines within a very short time of their conquest of the island. There is another interesting mine at Greenside, under the northern spur of Helvellyn, and it is claimed that this was the first metalliferous mine to make use of electricity.

J. SILVIE (Glasgow).

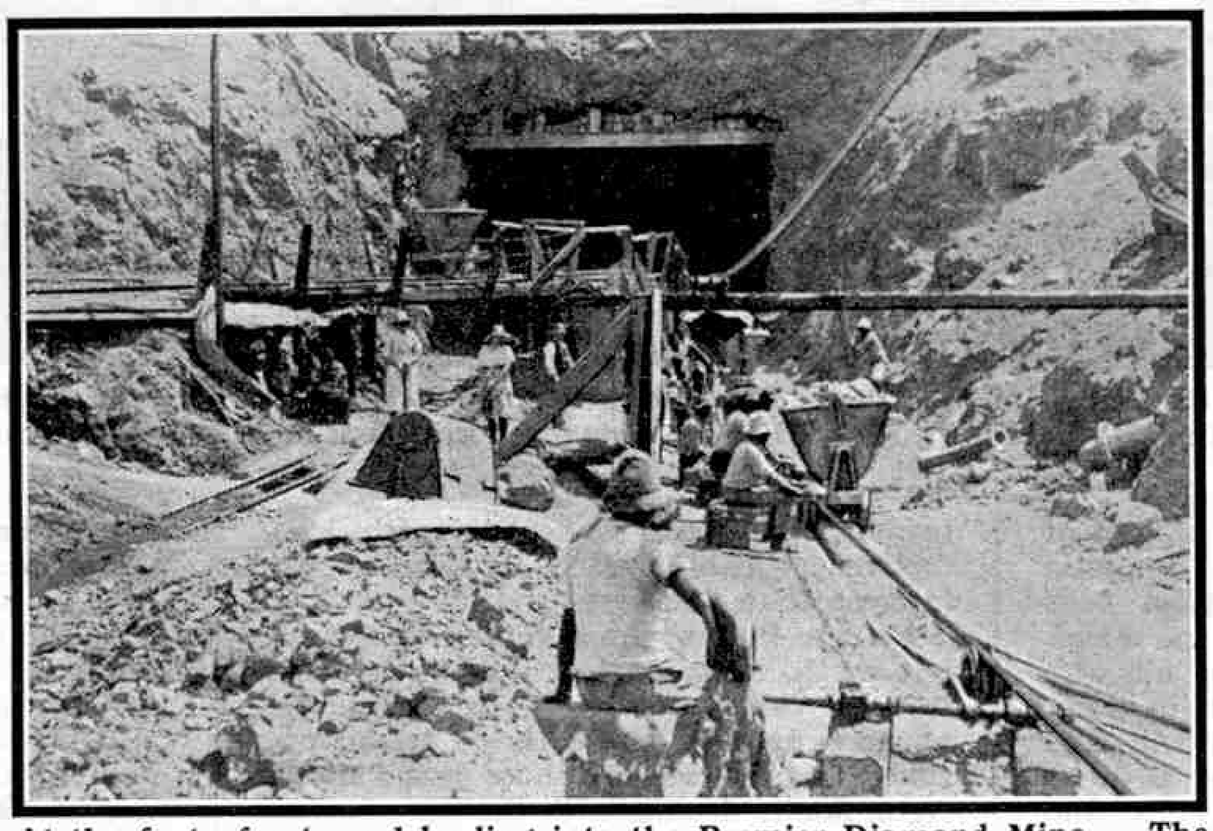
A Visit to the Premier Diamond Mine

The Premier Diamond Mine in the Transvaal, South Africa, is of very great interest for two reasons—it is the largest open face mine in the world, and in it was discovered the largest diamond yet seen. This was the Cullinan diamond, a famous stone that was $4\frac{1}{2}$ in. in length and $3{,}025\frac{3}{4}$ carats, or about $1\frac{1}{3}$ lb. in weight. The diamond was many times heavier than the largest stone previously known.

The Premier Diamond Mine, near Pretoria, South Africa, in which the world's largest diamond was found in 1905.

The mine in which this wonderful diamond was found was discovered in 1905 by Mr. Thomas Cullinan, after whom the world's largest diamond was named. The gems are found in what is known as "blue ground" and the first step in extracting them is to blast this out. For this purpose, 3,000 holes are bored by means of hand or power drills, and into each is placed a piece of dynamite to which is attached a detonator and a fuse. The latter is about 6 ft. in length and burns for about seven minutes, the interval being sufficient to allow the natives to seek safety when blasting is about to take place.

There are two blasts a day, each requiring 1,750 lbs. of dynamite. The noise is terrific and clouds of fumes are shot upwards. The blue ground broken up during the blasting is then hauled up in small trucks to the machinery in which it is crushed and washed. It is then sieved over greased tables, where the gravel is washed away, leaving the heavier diamonds attached to the grease. At intervals the tables are cleaned and the grease melted by heating in a cauldron. It may then be poured away, leaving behind it a residue consisting of diamonds mixed with a small proportion of gravel. The precious stones are then sorted by hand.



At the foot of a tunnel leading into the Premier Diamond Mine. The blue ground in which the precious stones are found is broken out by blasting and is then hauled to the surface in small trucks.

It was in 1905 that the Cullinan diamond was discovered in this mine by Mr. Wells, then mine manager. As he was making his usual round of the mine his attention was attracted by the glitter of a brilliant object embedded in the working face. Hurriedly he climbed up to extract it, and was astonished to find that it was a diamond far larger than any previously seen. The value of the stone was estimated to be more than £500,000. It was cut into nine pieces and these are now incorporated in the crowns of the King and Queen.

D. MALCOLM (Transvaal).

An Owl's Railway Journey

Birds have been known to build nests on the axle boxes of railway coaches and wagons in regular use, but they do not usually make rail journeys on the front of the locomotive. While standing recently in New Street Station, Birmingham, I saw the arrival of the 6.35 p.m. express from London. To my surprise an owl was firmly wedged between the handrail and the smokebox of the engine. As soon as the train came to a standstill the driver left his cab in order to release the bird. This was very much alive, but naturally greatly scared.

The driver told me that the owl had flown across the mouth of a tunnel near Rugby as the train approached at a speed of nearly 70 miles an hour. It had become trapped in the handrail and had been held there by the pressure of the wind while the train covered the remaining distance of about 30 miles into Birmingham. The bird was exhausted, but otherwise appeared little the worse for its amazing adventure.

A. J. RICHARDS (Birmingham).

A Visit to an Apiary

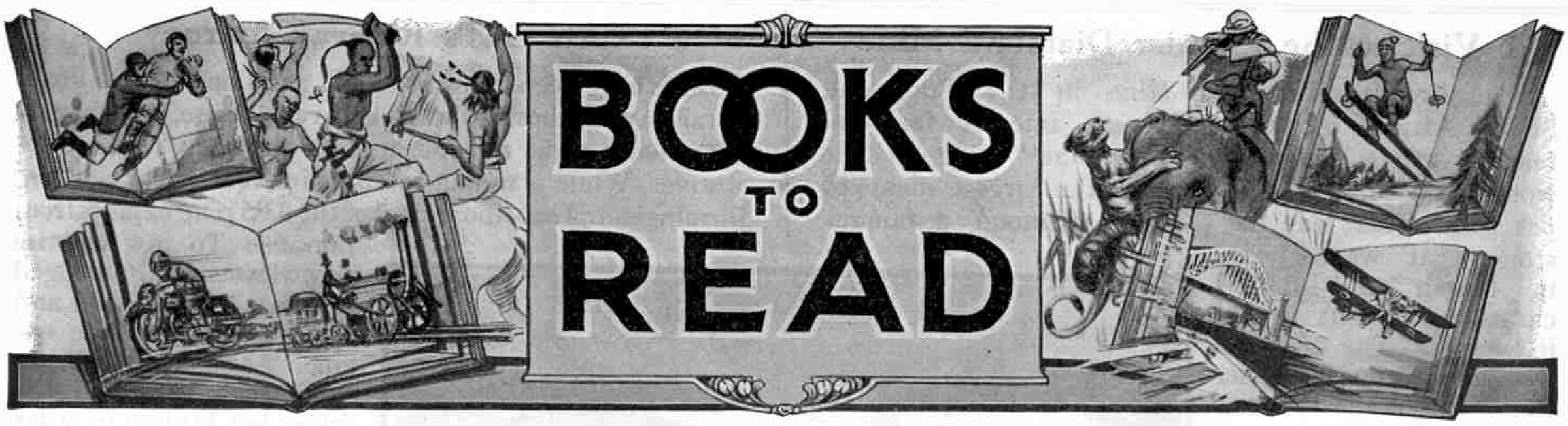
A short time ago I visited the apiary of an enthusiastic beekeeper, who interested me by comparing old and new methods of dealing with these insects.

Formerly the bees were allowed to make their combs in any position in the old 'skeps,' or straw, dome-shaped hives then in use, and at the end of the summer the insects were killed inside the skeps by sulphur fumes. The combs were extracted and, along with the dead bees and grubs, were placed in a muslin bag, from which the honey was allowed to drip.

The beekeeper then showed me the oblong wooden frames that now are placed in the hives. A thin sheet of beeswax reinforced by thin wires is stretched upon them, and the bees draw out the wax into hexagonal cells in which the queen bee lays her eggs.

Another set of cell-frames is placed above the first, a perforated zinc plate being placed between the two so that only workers may gain access to the upper cells. There they store the surplus honey. When these cells are full, the bees seal them. They may then be removed, the honey taken and the cells replaced, to receive a further store.

H. W. VINCENT (Monmouth).



On these pages we review books that are both of interest and of use to readers of the "M.M." We have made arrangements to supply copies of any of these books where readers find difficulty in obtaining them through the usual channels.

Orders should be addressed to the Book Dept., Meccano Limited, Old Swan, Liverpool, and 1/- should be added to the published price of the book to cover the cost of postage. The balance remaining will be refunded when the book is sent, as postages on different books vary according to the weight and destination.

"Electric Testing Simplified"

By H. H. U. Cross. (Crosby, Lockwood & Son. 5/-)

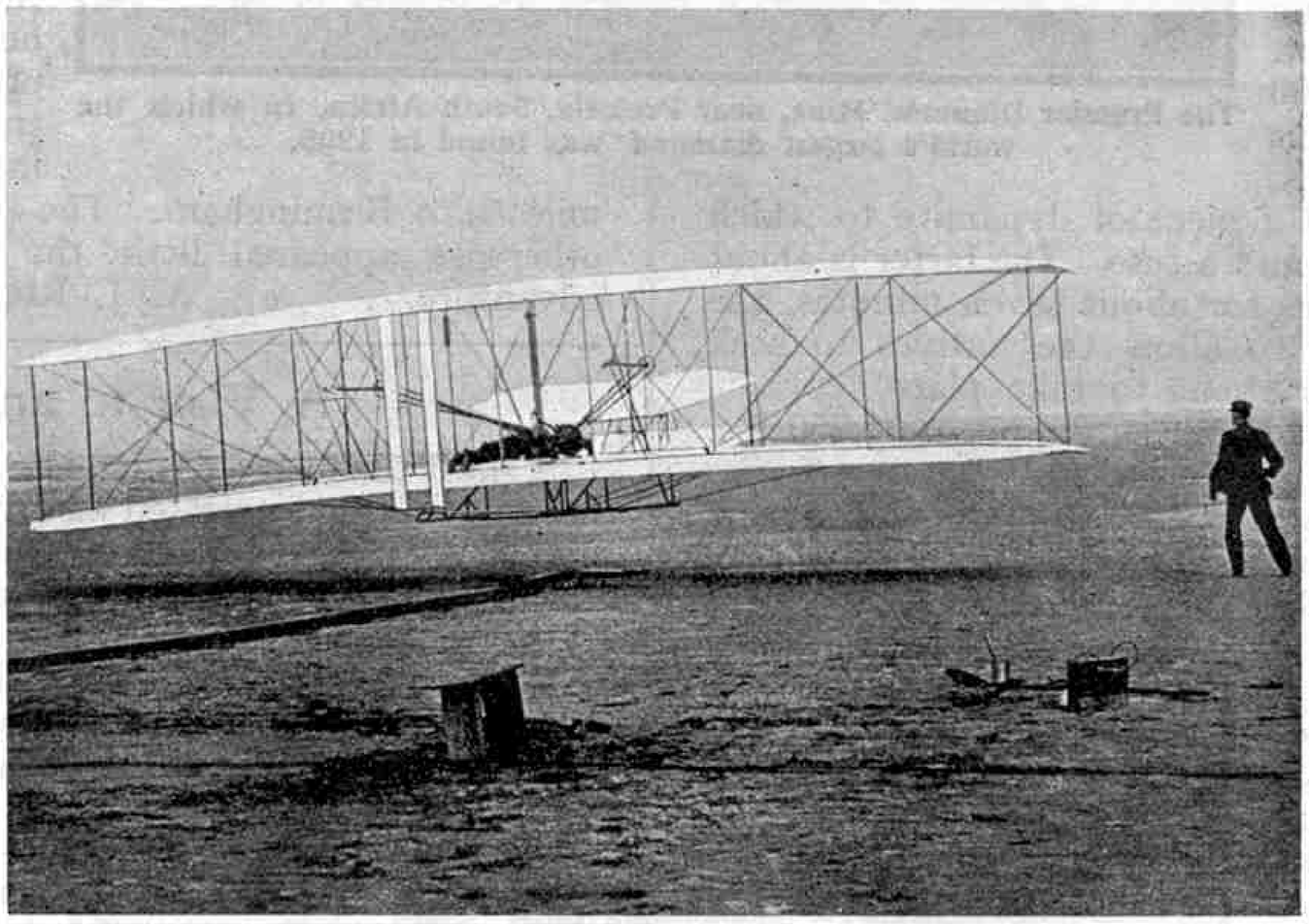
This recent addition to "Lockwood's Manuals" is of unusual interest and will be found of practical value to all who are interested in electrical apparatus. The opening chapter gives one of the simplest and most practical descriptions of the various electrical units that we have come across. The definitions are worded in such a manner as to make it impossible to misunderstand their meaning, and are in a form that is easy to remember. From here the author proceeds to deal with the various mechanisms and instruments employed for testing purposes, showing how they work and how they should be used and cared for. Meters of various kinds are particularly well described, and the chapters devoted to insulation testing and inspection and electrical resistance tests are excellently written.

Perhaps the most interesting section of the whole book is that devoted to domestic electrical appliances, ranging from bells to bath heaters. This section alone makes the book worth purchasing by all who have electric current installed in their houses. Wireless enthusiasts will find much to interest them in the author's comments on wet and dry cells and accumulators; there is a great deal of practical advice packed away here in small space. The final chapters deal with industrial dynamo and motor testing and the testing of motor-car electric plant. The book is well illustrated, the diagrams being particularly good.

"The World on Wheels"

By H. O. Duncan
(H. O. Duncan, Paris. 2 Vols. 30/-)

The author's exhaustive study of wheeled traffic in its inumerable forms has resulted in a mine of information illustrated with many curious sketches and historical reproductions. Some 40 years ago Mr. Duncan, who comes of a well-known sporting family, was famous as a professional cyclist and for some time he was champion of the world. Later he entered the motor trade, and at a date sufficiently early to share in the growth of the new mechanical marvels. As he has known most of the men who have taken part in motoring developments in both Europe and America, his reminiscences are exceedingly interesting. Although the whole of the book will, of course, interest our readers, that section dealing with locomotives probably will be of even greater interest than the rest.



Orville Wright piloting the 12 h.p. Wright biplane at Kitty Hawk, North Carolina, on the 17th December, 1903, when he made the world's first flight of twelve seconds. **(See next page).**

No one knows who invented the wheel, but we do know a great deal about early wheeled vehicles. The book begins with an account of the vehicles of pre-historic times, and follows with those of the Middle Ages, finally dealing with the age of steam and petrol.

The earliest developments of steam engineering are dealt with extensively, dating from a time that is long before the problem of the application of steam to purposes of transport had seriously arisen. The early work of such pioneers as Hero of Alexandria, Francis Bacon, and Newcomen, is dealt with non-technically, but in considerable detail.

The great impulse to invention, which resulted in what may be called the present Age of Speed, began with the nineteenth century. This impulse was given first by the application of steam and later by the invention of the internal combustion engine. Although the "iron horse" became a reality when Stephenson built the "*Locomotion*" for the Stockton and Darlington Railway, the "horseless carriage" only became a practical proposition much later. Nevertheless at an early date it was occupying the attention of inventors in America as well as in England and France. Joseph Cugnot had set steam-propelled wheels moving with his famous car as early as 1770. He was followed by numerous Englishmen with a series of steam coaches, some of which did actually travel over short distances at an average speed of 15 miles an hour. These steam coaches, even if they did not come to expectations, served to keep up the desire for greater speed in transportation.

The day came when Joseph Ravel rode out of his little workshop at Saint-Denis, on the outskirts of Paris, on a steam car in which oil was used instead of coke to heat the boiler. Shortly afterwards another Frenchman, Etienne Lenoir, invented the gas engine and the way was definitely opened for the appearance of the first automobiles—that was only 30 years ago!

The meteoric rise of the motor industry in every important country in Europe and in America is a fascinating story, and the monumental pioneer work of Count de Dion, which took place in the early eighties, makes most astonishing reading. Equally as interesting are the detailed accounts of such pioneers as Darracq, Renault, Charron, Delage and Daimler. Even to-day any mention of the famous Paris to Rouen race of 1894, in which such names as De Dion, Panhard, Peugeot and Benz leapt into fame, is sufficient to thrill the heart of many old-time motorists.

We wonder how many present-day motorists know that a four-cylinder rotary engine existed in 1890, and a twelve-cylinder engine of similar design in 1899? Much "out-of-the-way" information such as this occurs throughout the book, and this is one of the features that makes it such interesting reading.

There are also chapters on ancient vehicles and primitive methods of travel; the story of the bicycle; ancient and modern roads and their developments;

the history of the development of pneumatic tyres; and petrol and motor fuels.

The story of the motor industry in the various countries—Great Britain, Germany and America—has special chapters descriptive of each country. Naturally that on the development of the British industry is of most interest to us. Here we learn of such pioneers as Knight, Butler, Sterne, Edge, Jarrott, Pullinger, Shorland, Letts, Berlinger, Austin, Lanchester, Rolls and Coatalen—all of whom have their early struggles described. S. F. Edge has a chapter all to himself and his thrilling exploits in the Gordon-Bennett Race, as well as his successful early associations with the Napier and other cars, are described in detail. There is also a great deal about the early days of cycling and about the many flotations of vast motor companies in the days before the motor car was reliable—details such as are found nowhere else in literature.

This amazing book contains over 1,200 pages and 1,300 illustrations, and weighs over 12 lbs. It will keep any "*M.M.*" reader fully occupied for days in reading it, and for weeks in building Meccano models of the different vehicles, appliances and movements illustrated in its pages.

"Twenty-five Years of Flying"

By HARRY HARPER
(Hutchinson & Co. Ltd. 12/6)

Mr. Harry Harper, the well-known writer on aeronautics, furnishes the reader with something that is much more than a mere chronological record of air events from that historic day in 1903, when Orville Wright achieved the world's first aeroplane flight of 12 seconds duration. Mr. Harper has himself seen many of the pioneer flights from the dawn of aviation—for twenty-five years he has studied and written about the subject of aeronautics. He met and discussed the future with Wilbur and Orville Wright; he stood on the French coast beside Blériot, nineteen years ago, and watched him start on his famous flight to Dover; he was present at the world's first aviation meeting at Rheims; in a fast car he followed Grahame-White and Paulhan in their thrilling air race from London to Manchester. He has studied events "on the spot," and can describe vividly the personalities of airmen whose names are now world famous.

All this intimate personal knowledge of one of the greatest movements in history Mr. Harper sets forth graphically in his book. It is no compilation of facts and figures, but a living document, enriched throughout with the individual impressions of one who was there at the time when all these wonders of the air were being accomplished.

Early laughs and thrills; early model competitions; the first men to fly; flying the Atlantic; civil aviation; airway working; and the dawn of the air age, are some of the chapter headings. In this book Mr. Harper succeeds in making the past live again and we are able to see exactly what kind of men were the heroes of the early days of flying—pioneers whose work has made possible the conquest of the air to-day.

The book is exceptionally well illustrated with no less than 155 interesting photographs, depicting machines and important happenings from the infancy of flight to the present day.

"The Book of the Ship"

By G. GIBBARD JACKSON
(Sampson Low, Marston & Co. Ltd. 6/-)

One naturally expects a book of this nature to cover a great variety of subjects coming within the range of its scheme, and this clearly involves compression. At the same time there is a limit beyond which compression cannot go without unsatisfactory results, and it is easy to overstep this limit in the attempt to include everything. Mr. Jackson's book suffers from this defect. He sets out to cover in 250 pages the history and development of the ship from every point of view, including warships as well as merchant vessels, and in doing so he attempts the impossible. For instance, a description of early and modern warships compressed to some twenty-one pages is certain to be unsatisfactory; for the features that must be mentioned are so many that they resolve themselves into something resembling a catalogue. The reader is perfectly aware that the trouble is due to space limitations, and he ends by wishing the writer had left that particular phase alone altogether. Mr. Jackson further handicaps himself by including chapters on wrecks, unlucky ships, strange adventures of the sea, and other matters that are not really essential to his subject, and take up space that is badly wanted for dealing with more important matters.

Within the limits he has set himself, Mr. Jackson writes interestingly. He describes the fine ships of the "Clipper" era with enthusiasm and gives a good idea of the early struggles of the pioneers in propulsion by steam. His story of the development of the great shipping lines is attractive, and he gives an excellent account of the building of a ship and the manner in which a great liner is controlled and operated. One is glad to notice that the smaller vessels engaged in coastwise traffic or in fishing are given a place of their own. The last chapter of the book, entitled "The Coming of the Electric Ship," raises expectations, but it is exasperating to find that the chapter consists of less than two pages!

The book is illustrated on generous lines. There are fourteen full-page plates in colour and more than fifty other illustrations, many of them full-page and all well reproduced.

Hubert Latham's "Antoinette" monoplane on the cliffs near Calais. (From "Twenty-Five Years of Flying" reviewed on this page).

The late Sir John Alcock being congratulated after his Atlantic flight. (See above).

"Definitions for Aeronautical Students"

(Sir Isaac Pitman & Sons Ltd. 6d.)

The latest addition to the excellent sixpenny series of "Definitions and Formulæ for Students" deals with aeronautics. The first part of this well-compiled little book is devoted to definitions of aeronautical terms, and will be found useful by all who are interested in aeroplanes or airships. The definitions are clear and concise, and no more technical than is absolutely necessary. The remaining portion of the book is concerned with formulæ, and deals concisely with the calculations that are most commonly required by the student.

"Gradients of the London and North Eastern Railway"

By "VOYAGEUR"
(Railway Publishing Co. Ltd. 2/-)

This issue in volume form of the articles on the gradients of the L.N.E.R., published during 1929 in the "*Railway Magazine*," will be of interest to all railway enthusiasts, and particularly those who follow the fascinating hobby of "train-timing." The book consists of a series of gradient profiles drawn throughout to the same scale and accompanied by a descriptive commentary on the runs dealt with and complete tables of distances. The profiles are as fully detailed as is practicable, and indications are given of the position of service slacks, water troughs, tunnels and viaducts. The contents of the book are arranged in such a manner as to facilitate quick reference, and the profiles, in spite of the large amount of information they provide, are free from complications, so that it is perfectly easy to follow the course of a journey.

Interesting New Books

The undermentioned books, recently published, will be reviewed in a future issue.

"MY BOOK OF TRAINS"
by Ellison Hawks (T. C. & E. C. Jack. 2/-)

"GREAT STORMS"
by Lawton & Heddon (Philip Allan. 3/6)

"LOCOMOTIVE ENGINEERS' POCKET BOOK"
(The Locomotive Publishing Co. 3/6)

Results of Meccano Model-Building Contests

By Frank Hornby

"April" Competition (Home Sections)

THE full lists of prize-winners in the Home Sections of the "April" Model-building Competition are as follows:—

Section A (for competitors over 14 years of age).

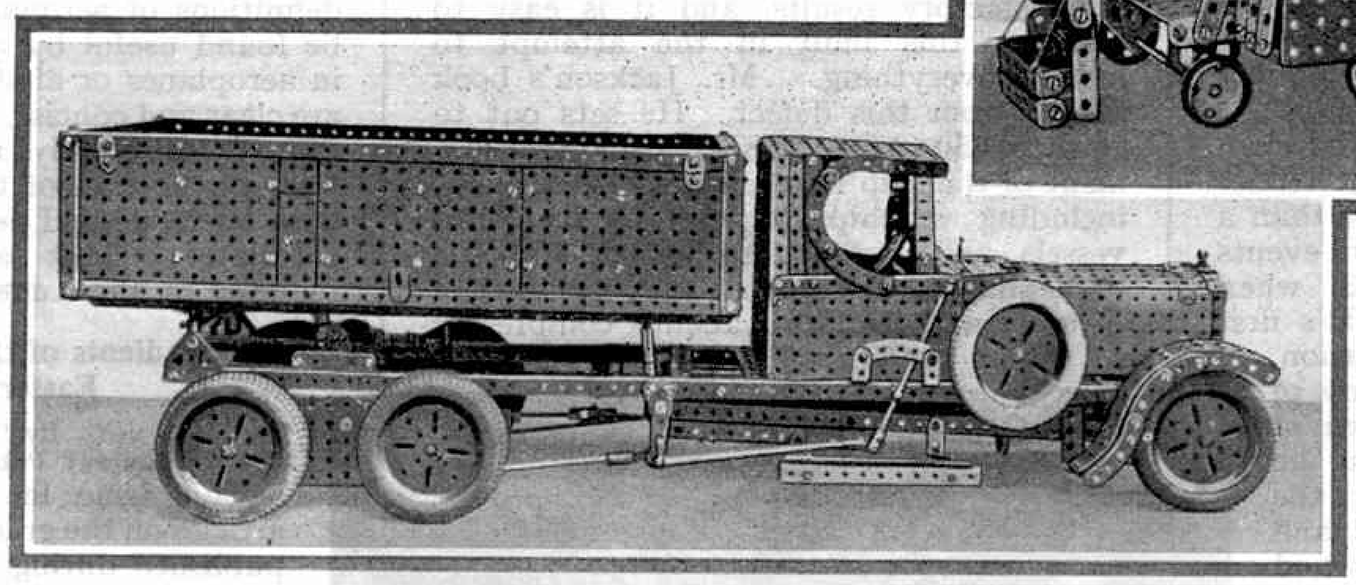
FIRST PRIZE, cheque for £2-2s.: G. W. Worthington, Little Hulton, Bolton, Lancs. SECOND PRIZE, cheque for £1-1s.: H. L. Collings, London, W.3. THIRD PRIZE, cheque for 10/6: William L. Williams, London, S.W.5.

TWELVE PRIZES, each consisting of Meccano products to value 5/-: C. J. Keates, Dulwich, London, S.E.21; Philip D. Banks, Dunstable, Beds.; C. W. Phillips, London, N.W.1; H. Turnecliffe, Nuneaton; R. F. Whiffen, Wimbledon Park, S.W.19; G. A. Merrett, Mayfair, W.1; C. P. Plantin, Westcliff-on-Sea; L. Elliott, Fleetwood; K. W. Cameron, Claughton, Birkenhead; H. L. Edwards, Tivoli, Cheltenham; A. K. G. Harper, Stourbridge; Frank Cockram, Swansea.

TWELVE PRIZES, each consisting of a copy of "Famous Trains" by C. J. Allen: Frank H. Parks, Peacehaven, Sussex; William Burke, Cork; George Moore, Bow, London, E.3; J. S. Lindsay, Southampton; F. S. Beard, Bristol; F. Jenner, Tottenham, London, N.15; Richard P. Walford, Lustleigh, Devon; J. Redding, Bridport, Dorset; John T. Ball, Forest Hill, London, S.E.23; George H. Minta, Nottingham; John E. Lockett, Manchester; Frank White, Birmingham.

TWELVE PRIZES, each consisting of a Meccano Engineers' Pocket Book: G. H. Thorndike, Salford, Manchester; R. H. Greenly, Hounslow, Middlesex; N. A. Hulbert, Trowbridge, Wilts.; W. F. Riddell, Berwick-on-Tweed; H. Fish, Sidmouth, Devon; O. H. Woodforde, Baldock, Herts.; I. Rowlands, Old Swan, Liverpool; B. and G. Wood, Bucknall, Stoke-on-Trent, Staffs.; James Wood Brown, Wimbledon, S.W.19; George B. Dines, Grays, Essex; E. Cousins, Sketty, Swansea; R. F. Newton, Buckhurst Hill, Essex.

SPECIALLY COMMENDED (Certificate of Merit): Jack C. Phillips, North Thoresby, Lincs.; G. S. De Ritter, Prenton, Cheshire; Albert McLeland, Margate, Kent; D. G. Goligher, London, S.W.7; Raymond Swainston, Davenport, Stockport; T. H. Parker, Manchester; L. Lovell, Margate, Kent; Percy Staden, London, S.E.6; A. Etherington and L. Wilcock, Bradford, Yorks.



Right: A neatly constructed Concrete-mixing Machine, built by L. Carman. Below: C. W. Phillips' realistic Tipping Motor Lorry.

Section B (for Competitors under 14 years of age).

FIRST PRIZE, cheque for £1-1s.: Aubrey Cattle, Leigh-on-Sea, Essex; SECOND PRIZE, cheque for 10/6: L. Carman, Manchester; THIRD PRIZE, cheque for 7/6: S. O. L. Andrew, Lees, near Oldham.

SIX PRIZES, each consisting of Meccano products to value 5/-: Albert Blackburn, Kelvedon, Essex; Roy Webb, Bishop's Stortford; Arnold Hood, Ipswich, Suffolk; E. J. Bottle, Worthing; Alan B. Storer, Ilford, Essex; R. E. Banks, Newton, Cambridge.

TWELVE PRIZES, each consisting of a Complete Instruction Manual: J. R. Bunce, Gerrards Cross, Bucks.; M. G. Thompson, Walthamstow, London, E.17; Stanley A. Crew, London, N.22; E. F. Scadding, Tyseley, Birmingham; Ronald Dickson, Belfast, Ireland; G. Ford, Bognor Regis, Sussex; Eric H. Spouge, London, S.E.16; Stanley Carter, London, S.E.20; Kenneth Goodacre, Parkstone, Dorset; J. E. Byrne, Mossley, Manchester; Fred Hole, Taunton, Somerset; Brian Douglas Hill, Bristol.

SPECIALLY COMMENDED (Certificate of Merit): David E. Morgan, London, S.E.14; G. McLaurin Brown, Handforth, Cheshire; Esmond Roden, Broadstairs, Kent; A. W. Selwyn, Rutland; R. Hibbard, London, N.9; S. Leveson, Gotherington, Near Cheltenham; Robert G. Scott, Chadwell Heath, Essex; C. Bartlett, Ropley, Hants.; E. Turner, Chelmsford, Essex; R. R. Jackson, Barnard Castle; H. Horsfield, Evesham; E. S. Shotter, Portsmouth; Allan Bonsor, Bedworth, Nuneaton; John Hewson, Worthing.

The First Prize in Section A was awarded to G. W. Worthington, whose fine model of a loom is one of the most practical examples of this type that has yet come to my notice. The model includes sixty healds per frame, the healds being made from strong linen thread knotted at the centre to form the eyes! Judging from a sample of cloth sent with this entry, the loom is capable of producing really excellent and serviceable material, which may be used in the making of such articles as ties and hat bands, etc.

A wonderful model of a grandfather clock earned the Second Prize for H. Leslie Collings. Not only is the clock an accurate timekeeper but it also strikes the hours on a gong, by means of an elaborate gear train that works on the rack repeating system.

W. L. Williams' entry comprised a machine for measuring and calculating the cost of cloth in any length up to nine yards. Unfortunately the internal mechanism of the model is too complicated to describe without the aid of illustrations. Machines of this type are in use everyday in the great London drapery establishments, where they save considerable time and labour in calculating accurately the cost of odd lengths of material.

C. W. Phillips' prize-winning motor lorry is illustrated herewith. Each of the two back axles is fitted with differential gear so that all four wheels receive the drive from the engine. Also each axle is suspended so as to be free to rise and fall vertically when travelling over rough ground. The model is operated by an Electric Motor, the drive from which is transmitted to the rear axles via a gear box of similar type to that described under Suggestion No. 162 in the "Suggestions Section" for July 1929. The body of the lorry is of the three-way tipping type, the tipping mechanism being connected to the gear box on operation of a lever in the driver's cab.

K. W. Cameron won his prize with a well designed demonstration model of an electric arc lamp, which incorporates mechanism for feeding the carbons towards each other as they are consumed. I take the opportunity to congratulate Cameron on the excellent drawings that he has submitted in recent competitions. It is indeed pleasing and helpful to receive such excellent work. The drawings are executed in a grey wash of water colour paint, the outline of the various Meccano parts being drawn in black ink, with the result that a splendid half-tone effect is produced.

In Section B the most interesting model is that constructed by Aubrey Cattle, who submitted a Meccano searchlight. The model is complete with a condenser lens and the lamp house is lined with white cardboard, which acts as a reflector. A 4-volt pocket lamp globe, supplied with current from a dry battery, is used as the illuminant. The lamp house is mounted pivotally and may be swivelled in any direction.

Leonard Carman took Second Prize in this Section with the model concrete mixing machine illustrated herewith. The construction of the bogie, hopper and bucket can clearly be seen from a glance at the illustration. The loader has two movements, namely, elevating and tipping. The latter operation is effected by means of a double hinged movement located in the base of the machine, and a suitably placed spring.

A realistic model of a motor cycle, in which the cylinder is represented by a Worm, secured the Third Prize for S. Andrew. The model is exceptionally well built and is complete with Dunlop Tyres, pedal-operated brake on the rear wheel and chain drive.

Other interesting models are a battleship by R. Webb and a passenger steamer by A. B. Storer.

"February" Competition (Overseas Section)

The names of the prize-winners in the Overseas Section of the February Model-building Competition are as follows:—

FIRST PRIZE, cheque for £3-3s.: W. Welsh, Ottawa, Canada; SECOND PRIZE, cheque for £2-2s.: D. D. Grieve, Bloemfontein, South Africa; THIRD PRIZE, cheque for £1-1s.: D. S. Lake, Bendigo, Victoria, Australia.

SIX PRIZES, each consisting of Meccano products to value 10/6: R. O. Jukes, Christchurch, New Zealand; R. Wallace, Durban, South Africa; C. J. McCain, Leichhardt, Sydney, Australia; P. L. Bargellini, Florence, Italy; F. Pantanella, Rome, Italy; C. E. Tremblay, Chicoutimi, P.Q., Canada.

SIX PRIZES, each consisting of Meccano products to value 5/-: R. B. McMillan, Melbourne, Australia; Ian T. G. Johnstone, Wellington, New Zealand; Walter Fagg, Milton, Otago, New Zealand; W. D. Baker, Riverside, Calif., U.S.A.; P. Anagnoseopoulos, Athens, Greece; A.v. Ooijen Jr., Nijmegen, Holland.

SIX PRIZES each consisting of a copy of "Famous Trains" by C. J. Allen: J. A. Laskaris, Athens, Greece; A. Masterton, Cambridge, South Africa; R. Hedley, Melbourne, Australia; M. B. Allan, Toronto, Canada; M. Frankel, Muizenberg, Cape Town, S. Africa; Ian L. Taylor, Nawera, New Zealand.

TWELVE PRIZES, each consisting of a Meccano Engineers' Pocket Book; W. Scott Hayward, Grahamstown, South Africa; K. Hibbs, South Canterbury, New Zealand; H. St. Michel, Quebec, Canada; Eric Levin, Johannesburg, S. Africa; Nelson Parton, Sydney, Australia; H. E. Gairdiner, Troy, Ontario, Canada; R. A. Anderson, Ashfield, N.S.W.; J. R. Sandle, Palmerston North, New Zealand; N. S. Variava, Bombay, India; M. Wills, Sydney, Australia; Ian Millar, New Plymouth, New Zealand; Archie Carson, Toronto, Canada.

W. Welsh secured First Prize with a reproduction of the Peace Tower—a portion of the Parliament Buildings at Ottawa. Like the prototype, which, by the way, is the highest structure in Ottawa, the model is built on imposing lines. It incorporates a realistic electric clock, but unfortunately, explicit details of the mechanism of the clock are not available, so I am unable to describe its construction.

The aeroplane catapult with which D. D. Grieve won Second Prize is, I think, the first model of this subject I have seen. It is based on the actual catapults used on warships for the purpose of launching aeroplanes from their decks at a sufficiently high speed to enable them to take the air without the use of a long runway. The model incorporates a bogie running on rails and operated by a powerful spring, and the entire catapult revolves on built-up ball bearings.

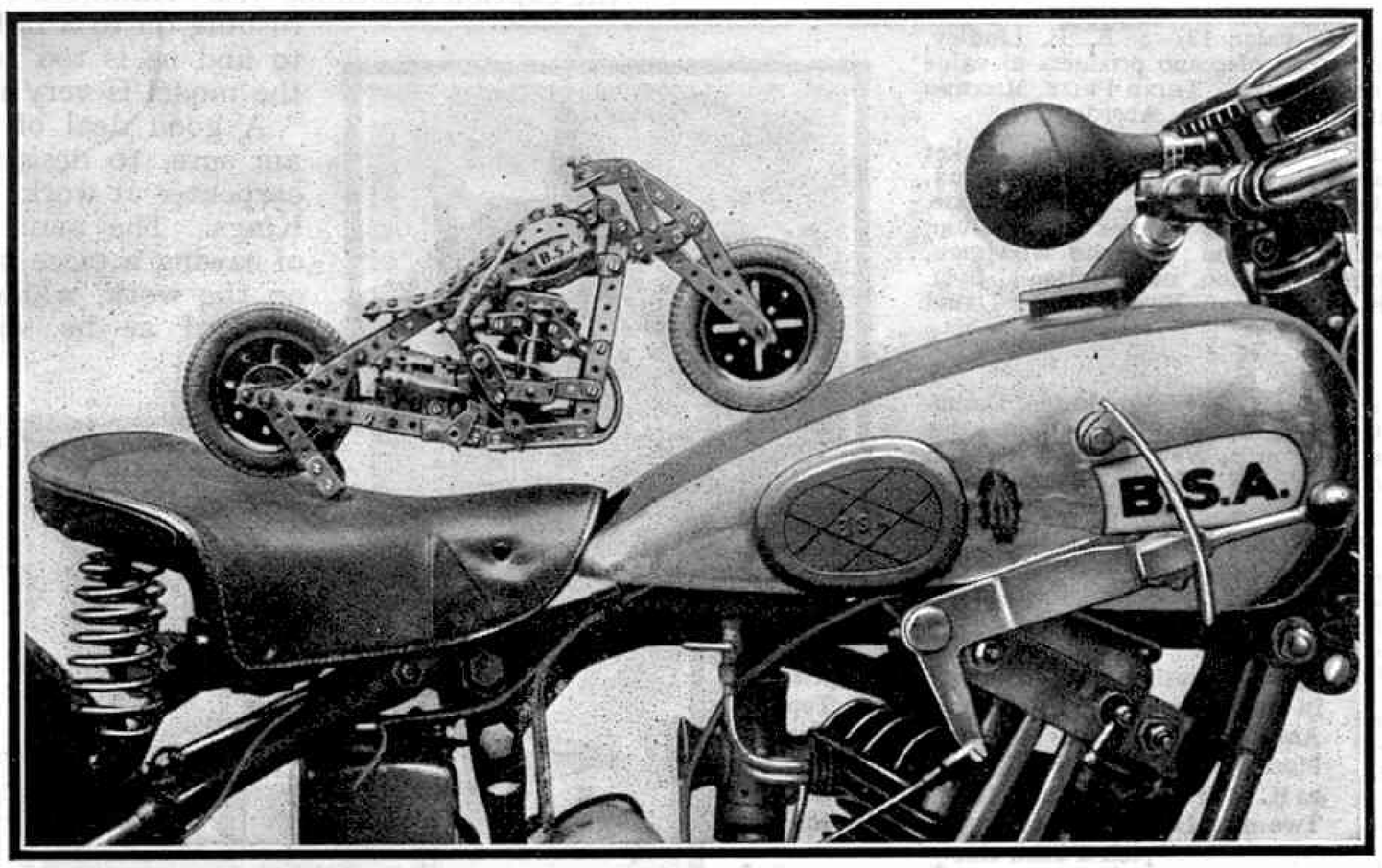
Mr. D. S. Lake secured Third Prize with the fine model of a B.S.A. motor cycle illustrated on this page. It is complete with spring front fork, overhead valves, rear brake actuated by a brake pedal, and a change gear lever, which operates a neatly constructed two-speed gear box. The model has been highly commended by the B.S.A. Cycle Co. Ltd., to whom it was submitted for examination.

R. O. Jukes, a keen Meccanoite who has achieved model-building distinction on several previous occasions, again features in the prize-list. His model, which is illustrated herewith, is a reproduction of the British "Ljungström" locomotive, which was described and illustrated on page 620 of the "*M.M.*" for July 1927. In the model the six coupled wheels are driven by an Electric Motor. The interior of the cab is complete with all the usual fittings, such as water gauges, regulator and fire box door, and the external details include electric headlamps, the current for which is supplied by a 4-volt pocket lamp battery.

R. Wallace submitted an ingeniously constructed model of a D.G. 6 T. type (double geared, six-wheel, tipping) Sentinel steam wagon. The body of the model is capable of tipping endways or to either side. The chassis includes a two-speed gear-box, differential, internal expanding brakes on all rear wheels, worm-driven Ackermann steering, and windscreens. An imitation two-cylinder steam engine is a further interesting feature.

C. J. McCain's model is a cleverly designed coke oven ram. The operation of the model is too intricate to describe without the aid of illustrations. P. L. Bargellini submitted a model of an Italian State Railway locomotive, the most interesting feature of which is a splendid workable reproduction of Walschaerts' valve gear. C. E. Tremblay and Francesco Pantanella submitted models of a gantry type crane and a Dornier Super Val aeroplane respectively.

Amongst the winners of the smaller prizes a notable model is the giant cable laying machine submitted by Walter Fagg. The prototype of Fagg's model was described and illustrated in the "*M.M.*" for October 1928. Another interesting entry is that submitted by R. B. McMillan. It is a reproduction of an old-fashioned Melbourne cable tramcar. In this type of tram, the power for travelling was provided by a moving wire cable, placed between the running rails. A claw-like "grip" was fitted underneath the tram and so arranged that the driver could either engage or disengage it with the moving cable simply by operating a lever, and thus start or stop the tram!



Still another version of "Dignity and Impudence"! Although fitted with a workable gear box, overhead valves and brakes, Mr. Denis S. Lake's model B.S.A. Motor Cycle is small enough to stand on the saddle of the actual machine.

Second "Parts Required" Contest (Overseas)

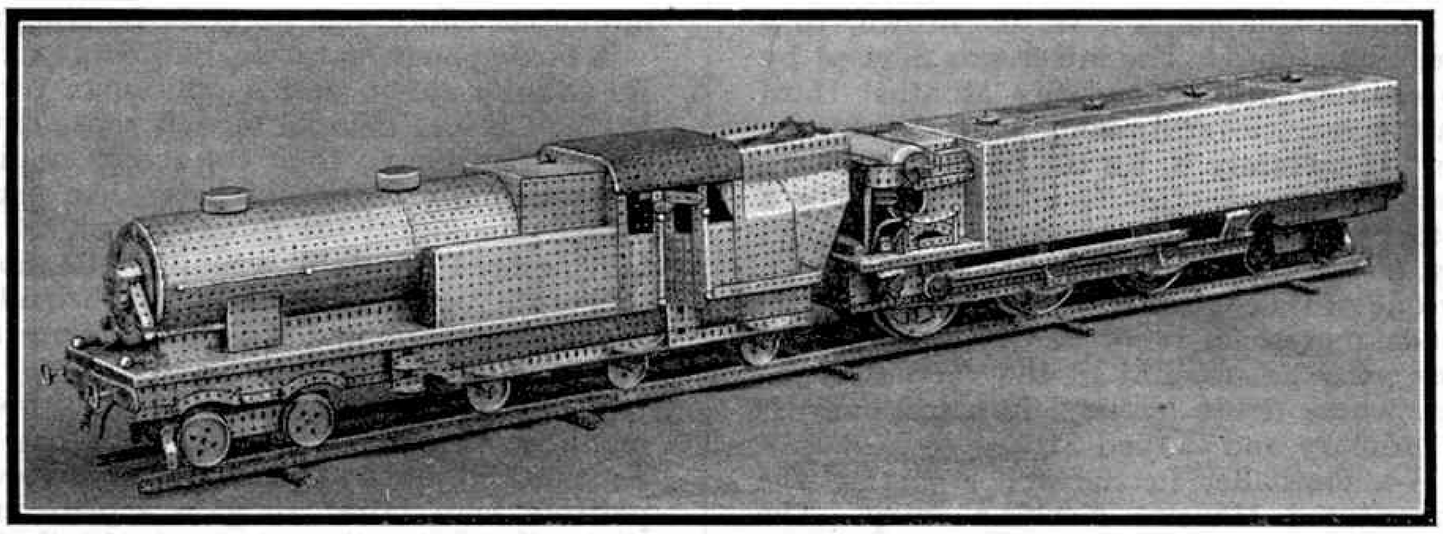
Amongst the many hundreds of entries received in the Overseas Section of the Second "Parts Required" Competition, no single competitor was able to make an absolutely correct list of the parts used in building the model motor lorry that was the subject of the competition, and accordingly the prizes were awarded to those competitors whose lists were most nearly correct. Under this system the following competitors secured prizes:—

FIRST PRIZE, Meccano products to value £1-1s.: N. Boyadiakis, Salonica, Greece. SECOND PRIZE, Meccano products to value 15/-: Thopho Fotori, Salonica, Greece. THIRD PRIZE, Meccano products to value 10/6: D. D. Grieve, Bloemfontein S. Africa.

TWELVE PRIZES, each consisting of a Meccano Engineers' Pocket Book: D. C. Tzitzinias, Salonica, Greece; S. Frankel, Cape Town, S. Africa; W. Russell, Whangarei, New Zealand; J. A. Gomes, Bandra, Bombay, India; James Elsmore, Levin, North Island, New Zealand; A. Lancefield, Saskatoon, Saskatchewan, Canada; C. J. McCain, Sydney, Australia; K. J. Orams, Blenheim, New Zealand; Roy Atkinson, Punchbowl, N.S.W.; Roy Walton, Darlinghurst, Sydney, Australia; Dick Atkinson, Punchbowl, N.S.W.; R. Renard, Gand, Belgium.

SPECIALLY COMMENDED (Certificate of Merit): Harry C. Nevins, Toronto, Canada; Abdul W. Pasha, Aligarh, India; Desmond R. White, Bangalore, India; Cyril Pollard, Pietermaritzburg, South Africa; J. L. Busey, Seldovia, Alaska; Eric Allen, Pukekohe, New Zealand; A. Smith, Brisbane, Queensland; Harold Green, Melbourne, Australia.

Most competitors overlooked the fact that the lorry is loaded with several Meccano Miniature Sacks, and the few competitors who did include the Sacks in their lists estimated the number incorrectly.



The power, speed, and distinguished appearance of a British "Ljungstrom" type locomotive are cleverly suggested in this model by R. O. Jukes.

"Meccanitian" Competition (Home and Overseas)

This competition, which was first announced in the February, 1930, "*M.M.*" struck an entirely new note, for it was organised specially for the benefit of the younger Meccano boys and girls. Competitors were asked to build a simple little model of a "Meccano man" engaged in some everyday task, and prizes were offered for the most ingenious or humorous models submitted. The competition provided an amusing and searching test for young Meccanoites and some very interesting entries were received. The names of the prize-winners are as follows:—

Section A (Home)

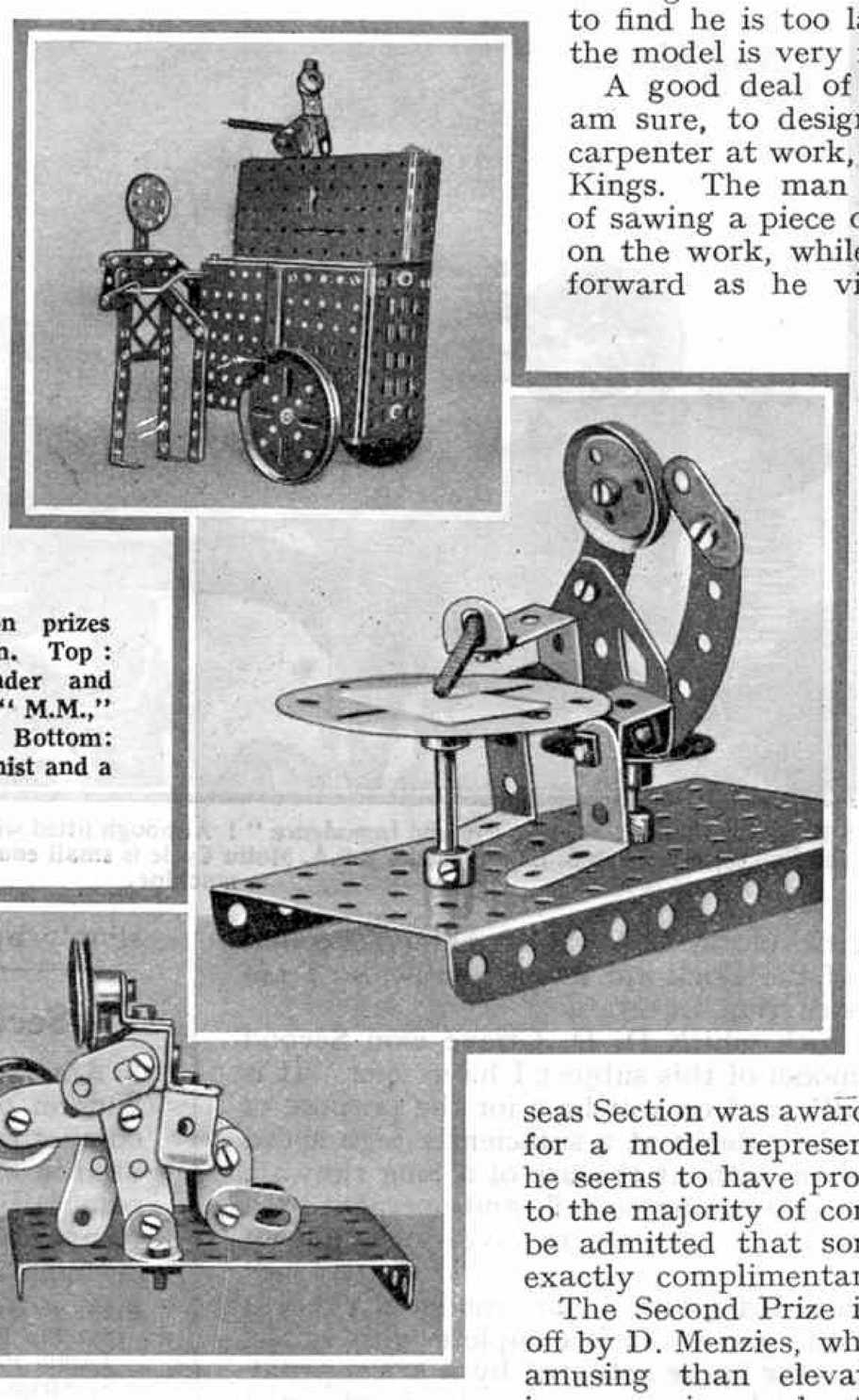
FIRST PRIZE, Meccano products to value 15/-: K. F. Lindley, Kingswood, Surrey. SECOND PRIZE, Meccano products to value 10/-: J. Gunstone, Beaconsfield, Bucks. THIRD PRIZE, Meccano products to value 5/-: Anthony Johnston, Aberdeen.

TWELVE PRIZES, each consisting of a Meccano Engineers' Pocket Book: Harry Parker, Grimsby; Albert Swailes, North End, Portsmouth; Cecil James, Harlington, Middx.; Maurice Koskie, Hull; Fred Eyre, Harpurhey, Manchester; Derek Aslin, Olton, Birmingham; Frank Sidebottom, Bolton; Charlie Woodman, Fleet, Hants.; John F. Kings, Rivington, near Bolton; J. D. Hamilton, Cheltenham; J. K. H. Freeman, Birmingham; David Hobby, Chepstow.

Section B (Overseas)

FIRST PRIZE, Meccano products to value 15/-: Jim Jessen, Dargaville, New Zealand. SECOND PRIZE, Meccano products to value 10/-: David Menzies, New Plymouth, New Zealand. THIRD PRIZE, Meccano products to value 5/-: Eric Levin, Johannesburg, South Africa.

SIX PRIZES, each consisting of a Meccano Engineers' Pocket Book: Roddick Grant, Lindsay, Ont., Canada; Mick Casey, Marlborough, New Zealand; B. Sandle, Palmerston North, New Zealand; Kingsley Hibbs, Geraldine, S. Canterbury, New Zealand; Leslie Haigh, Port Elizabeth, S. Africa; N. K. Tzitzinias, Salonica, Greece.



Three amusing models that won prizes in the "Meccanitian" Competition. Top: Anthony Johnston's Organ Grinder and Monkey. Right: The Editor of the "M.M.," as K. F. Lindley imagines him to be! Bottom: Two models by J. Gunstone—a pianist and a "pick-a-back ride"

The amount of "life" and "expression" that K. F. Lindley has succeeded in putting into a few Meccano parts is truly remarkable. His very humorous model represents the Editor of the "*M.M.*" seated at his desk, and is illustrated herewith. It is quite obvious that the Editor is in the act of elucidating a particularly knotty problem sent to him by one of his innumerable Meccano friends. The model is particularly noteworthy in view of the fact that Lindley is not yet twelve years of age.

J. Gunstone's clever little models also are illustrated herewith. I do not think it is necessary to explain what they represent! A. Johnstone's amusing entry, an organ grinder and his monkey, is the third illustration.

Some idea of the tremendous variety of subjects covered by the entries may be gained from the fact that models ranged from a very amusing model of Charlie Chaplin, by W. G. Brown, to a convict hard at work breaking stones! The latter was devised by Charlie Woodman, who entitled his model "Six Months' Hard Labour." Judging from the very clever drawing which Woodman submitted, "hard labour" it certainly is, for the convict is shown with a huge hammer raised high over his shoulder ready for a powerful blow on the stones and rock on which he is working! The hammer, by the way, comprises a 4" Rod on the end of which a Coupling is secured by one of its central transverse holes.

Frank Sidebottom's model represents a butler carrying a heavily-laden salver! It is noteworthy on account of the very dignified appearance of the butler, whose figure (clothed in a tail coat) is attained with the aid of ordinary and Curved Strips.

The "Penalty Kick"—a footballer in the act of taking the kick from the spot—constituted Maurice Koskie's entry. The pose of the footballer is excellent.

"Father minds the baby" was the bright inspiration of Cecil James, aged 11 years. Father is shown seated on a chair reading a newspaper with baby contentedly resting in his lap. "Baby" comprises a Fork Piece, in the boss of which a bolt is secured to form the head! A strolling player, reminiscent of the old time minstrels, with a Chimney Adaptor for a hat perched at a precarious angle on his head, comprises the laughable effort of A. Swailes, while Harry Parker, a young cricket enthusiast, elected to try his luck with a model representing a wicket keeper.

"Hi Porter, I've missed my train! Quick, stop it!" This is the caption describing J. D. Hamilton's Meccanitian, who is shown rushing on to a railway station platform only to find he is too late! The general effect of the model is very realistic.

A good deal of thought was necessary, I am sure, to design the realistic model of a carpenter at work, which won a prize for J. F. Kings. The man is represented in the act of sawing a piece of wood. He has one knee on the work, while his body is bent slightly forward as he vigorously works the saw. The latter, by the way, is represented by a Strip; a Rack Strip would be very realistic here.

Before passing on to the Overseas Section I must mention a splendid little model of a gardener at work. It was built by Derek Aslin, a keen Meccanoite who, although not yet 8 years old, thus has the satisfaction of gaining model-building distinction with a very praiseworthy effort. I hope Derek will continue to participate in Meccano Competitions, for I feel sure he will have a distinguished career as a model-builder.

Curiously enough, the First Prize in the Overseas Section was awarded, as in the Home Section, for a model representing the Editor. Indeed, he seems to have proved a source of inspiration to the majority of competitors, although it must be admitted that some of the models are not exactly complimentary!

The Second Prize in this Section was carried off by D. Menzies, whose model is perhaps more amusing than elevating! It depicts a man in a semi-recumbent position with one arm stretched behind to support him while with the other he holds the inevitable bottle to his lips as he drains the last few drops! The bottle, by the way, is represented by a Coupling and it is applied to a hole in the boss of a Bush Wheel that comprises the drunkard's head!

An amusing model of a cowboy "buck jumping" in true Wild West fashion secured Third Prize. Eric Levin is responsible for this humorous effort and he is to be congratulated on his originality.

A boxing bout featuring Phil Scott and Jack Sharkey, comprised R. Grant's entry, and a policeman directing traffic won a prize for M. Casey. Several models representing schoolmasters dealing out castigation to their refractory pupils are prominent amongst the remaining entries of note. An excellent model of this type secured an award for B. Sandle.

Kingsley Hibbs built a simple little model depicting a woodcutter at work. With his axe swinging through the air, the man is busily engaged in chopping logs, while close at hand is a wheelbarrow into which the chips are being loaded.

There are many other interesting models that I am unable to mention owing to lack of space. A new "Simplicity" Competition will shortly be announced, however, and I advise those competitors who failed to gain a prize in this Contest to continue their efforts, for there is no doubt that with perseverance many of them will be amongst the prize-winners.

GRAND AUTUMN
Model-Building Competition
Cash Prizes for New Models!

New Judging System offers splendid chance to every Competitor

THIS month we are able to announce a grand new Model-building Competition in which a large number of valuable prizes are offered to "*M.M.*" readers. In this, as in all previous contests, every owner of a Meccano Outfit is eligible to compete.

All you have to do is to build a realistic new Meccano model, and then send a photograph or a clear drawing of it to Meccano Limited. Photographs or drawings need not be your own work, but the model *must* be the result of your own unaided efforts.

The Contest will be divided into three Sections, as follows: Section A, for readers residing in the British Isles and over 14 years of age; Section B, for readers residing in the British Isles and under 14 years of age; Section C, for readers of all ages residing Overseas.

Your age, name and address must appear on the back of each photograph or sheet of paper submitted, together with the name of the competition ("Autumn") and the Section (A, B, or C) in which the model is entered. Envelopes enclosing entries are to be addressed to "Autumn" Model-building Competition, Meccano Ltd., Old Swan, Liverpool.

The prizes to be awarded in each of the two Sections A and C are as follows: First Prize: Cheque for £3-3s. Second Prize: Cheque for £2-2s. Third Prize: Cheque for £1-1s.

Six Prizes, each consisting of Meccano goods to value 10/6. Twelve Prizes, each consisting of Meccano goods to value 5/–. Twelve Prizes, each consisting of a Meccano Engineers' Pocket Book.

The prizes to be awarded in Section B are: First Prize: Cheque for £2-2s. Second Prize: Cheque for £1-1s. Third Prize: Cheque for 10/6. Twelve Prizes, each consisting of Meccano goods to value 5/–. Six Prizes, each consisting of a Meccano Engineers' Pocket Book.

31st October, 1930, is the last day on which entries may be received in the Home Sections (A and B). Overseas readers must forward their entries so that they reach Liverpool not later than 31st January, 1931.

In making the awards, the judges of the competition will allot points according to the merits of each entry when considered under the following heads:—

Construction: Models should be built on correct mechanical principles and they should be strong and cleanly designed. It is best only to use standard Meccano parts throughout, and the parts should not be altered or mutilated in any way. Maximum number of points obtainable under this head: 20.

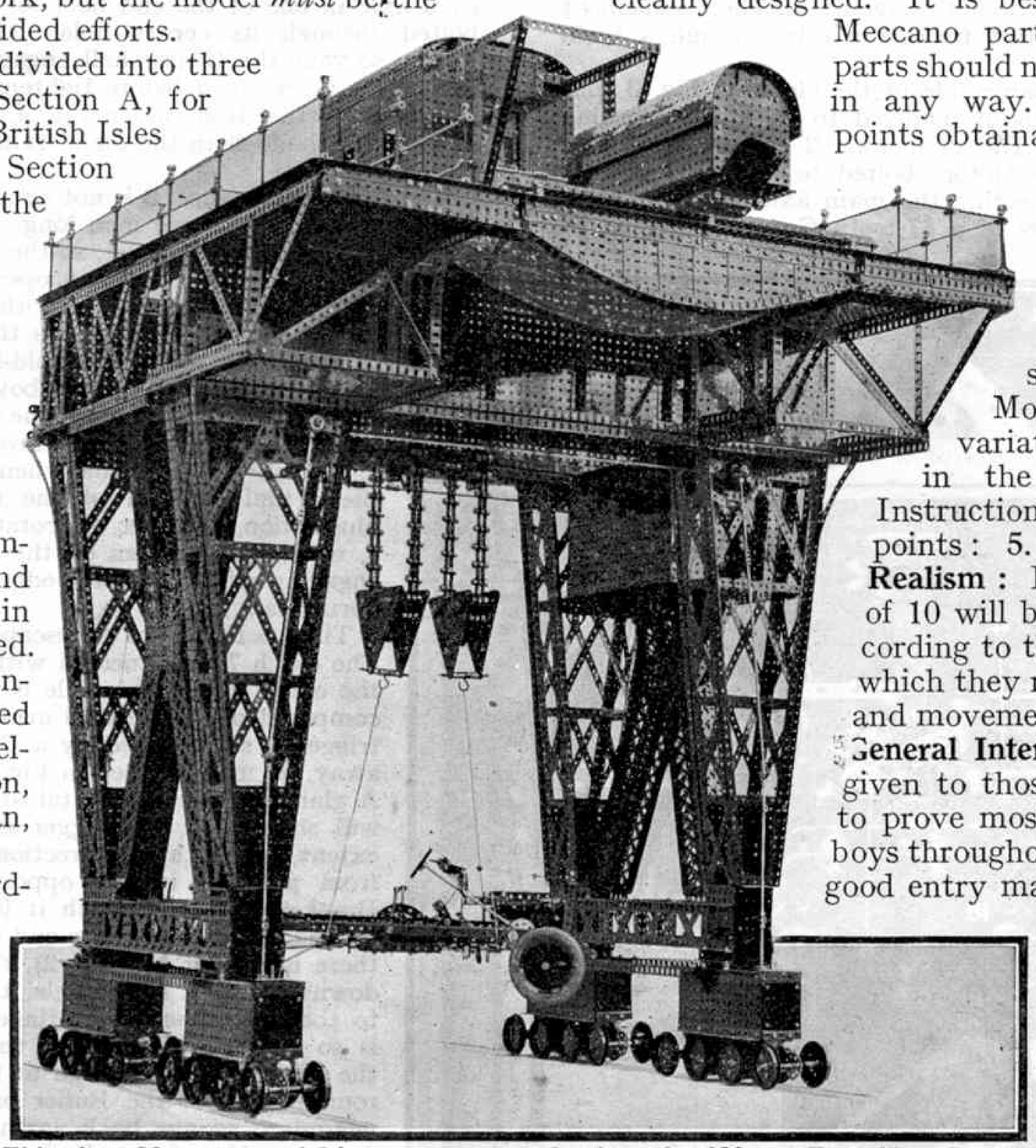
Originality: Competitors should be as original as possible, either with respect to the choice of subject or to the method of construction of their entries. Models should not be merely variations of those illustrated in the Meccano Manuals of Instructions. Maximum number of points: 5.

Realism: Points up to a maximum of 10 will be awarded to models according to the degree of realism with which they reproduce the appearance and movements of the prototypes.

General Interest: Preference will be given to those models that are likely to prove most interesting to Meccano boys throughout the world, and a really good entry may earn a maximum of 5 points under this head.

Age: Each competitor's age will be considered and points will be added to the total gained by his model according to the following scale. This will ensure the younger boys having an equal chance with the older competitors.

Section A: Competitors aged 14 years, 10 points; 15 years, 9; 16 years, 8; 17 years, 6; 18 years, 4; 19 years, 2; over 20 years, nil. **Section B:** Under 7 years, 10 points; 7 years, 9; 8 years, 8; 9 years, 6; 10 years, 5; 11 years, 4; 12 to 13 years, 2. **Section C:** Under 8 years, 10 points; 8 years, 9; 9 years, 8; 10 years, 7; 11 years, 6; 12 years, 5; 13 years, 4; 14 years, 3; 15 years, 2; 16-18 years, 1; 19 and over, nil. Competitors must take care to state their ages carefully on their entries.



This giant Meccano model is an exact reproduction of a 480-ton Travelling Gantry Crane.

Meccano Clock Nearly 10 ft. High

Bombay Government Official's Wonderful Model

Below we conclude the description of a remarkable working clock constructed from Meccano parts by Lt.-Col. B. Higham, I.M.S. The first part of the article, which appeared last month, was illustrated by a general view of the clock (Fig. 1) and a view of the mechanism from the "three o'clock side" (Fig. 2).

THE mainshaft is shown at 2 in Fig. 3. Bolted to its free end and seen in the foreground is the driving Sprocket of the three side Motors, and a little farther back is the Sprocket that receives the drive from the nearer of the two back pairs of Motors. The axle revolves clockwise, as viewed from this aspect, and its rotation is transmitted directly to the minute-hand of the clock through a Worm-and-Pinion gear 3. The axle 4 of the minute-hand can also be seen in this figure running along horizontally with the Pinion bolted to its left-hand end. With a Worm and ½" Pinion the Worm has to revolve 20 times* to effect one revolution of the Pinion. Since the Pinion is on the axle of the minute-hand, it must revolve once in every hour, and the main axle must therefore be made to rotate exactly 20 times* per hour for the clock to keep correct time. This speed is maintained by the pendulum through the agency of the escapement wheel, which is connected with the main axle through a train of three gears.

Fig. 4 is taken from the same side of the clock as Fig. 3, but the three side Motors have been removed to show the working of the parts behind them. The main axle 2 can be seen with the Sprocket of the missing Motors bolted to its free end.

Of the train of gears connecting the main axle to the escapement wheel, the first consists of a 57-teeth Gear engaging with a 38-teeth Gear, and the first subsidiary axle therefore rotates 30 times per hour. The next gear consists of a 50-teeth Gear Wheel 5 engaging with a 20-teeth Pinion, and the axle of this consequently rotates 75 times per hour. The last gear consists again of a 50-teeth Gear Wheel and a 20-teeth Pinion, so that the latter's axle, to which the escapement wheel is bolted, rotates 187½ times per hour. Only two of the four axles in the transmission, namely, the first and the last, go right across the clock from one side to the other. The other two go only half-way across, and are supported there by a piece of the framework not visible in the illustration. In this way a space is left in which the escapement wheel may revolve.

The difficulty of getting Gear Wheels and Pinions of these sizes to mesh with each other has been surmounted by journalling each axle in one of the end holes of a 1½" Strip that, in turn, is bolted through its centre hole. The proper setting of these Strips, so that the Gears shall engage nicely and without undue friction, is ascertained before tightening up their attaching bolts. This construction is shown in Fig. 4, where the 1½" Strips appear in a darker shade than the main frame member to which they are bolted.

The escapement wheel 6 is not circular but is a regular octagon, each side of which is one inch long. Each side is actually made of a 2" Strip, however, so the periphery of the octagon has eight projections, and in operation it acts as a cog-wheel with eight teeth. Each tooth has a ½" × ½" Angle Bracket bolted to it and this gives the whole unit a resemblance to the paddle wheel of an old-fashioned steamboat. Three of its teeth can be seen above the main side member of the frame and two below, the other two teeth being hidden from view. It is driven through the train of gears in an anti-clockwise direction when observed as in Fig. 4. In the actual position of the mechanism depicted in the illustration, however, its rotation is prevented by a catch 7, which can be seen on the right-hand side of the wheel engaging with the outer edge of the tooth that is placed horizontally.

The mechanism of the escapement may now be described. The catch 7 is connected with the axle 8 (Fig. 3), and to the other end of this axle is attached a kind of trigger 9 composed of the vertical arm of a Boss Bell Crank. The trigger is surmounted by a Buffer that has one edge filed away, as may be seen in Fig. 2 (in last month's "*M.M.*"). A glance at the horizontal arm of the Crank in this view will show that the trigger is free to move to a limited extent in a clockwise direction, but is altogether prevented from rotating in the opposite direction by the Angle Bracket 10, upon which it is shown resting.

Attached to the lower end of the pendulum on this side there is a lever 11 (Fig. 2), the free end of which is bent downward at a right-angle, the other end being attached to the pendulum by a Hinge. The height of this lever is so arranged that when the pendulum swings towards the left the bottom edge of the lever just rides over the rounded top of the Buffer on the trigger, but when the pendulum swings back again the lever engages with the flat cut side of the Buffer and draws the trigger over with it towards the right. As the trigger rotates about its pivot the elevation of the buffer decreases, of course, and this downward movement soon frees it from the lever. When released the trigger falls back on its stop, the pendulum continuing on its course unfettered.

The movement of the trigger has involved corresponding movements in the catch on the escapement wheel, both of them being secured to the same axle. The first movement of the catch has liberated the escapement wheel

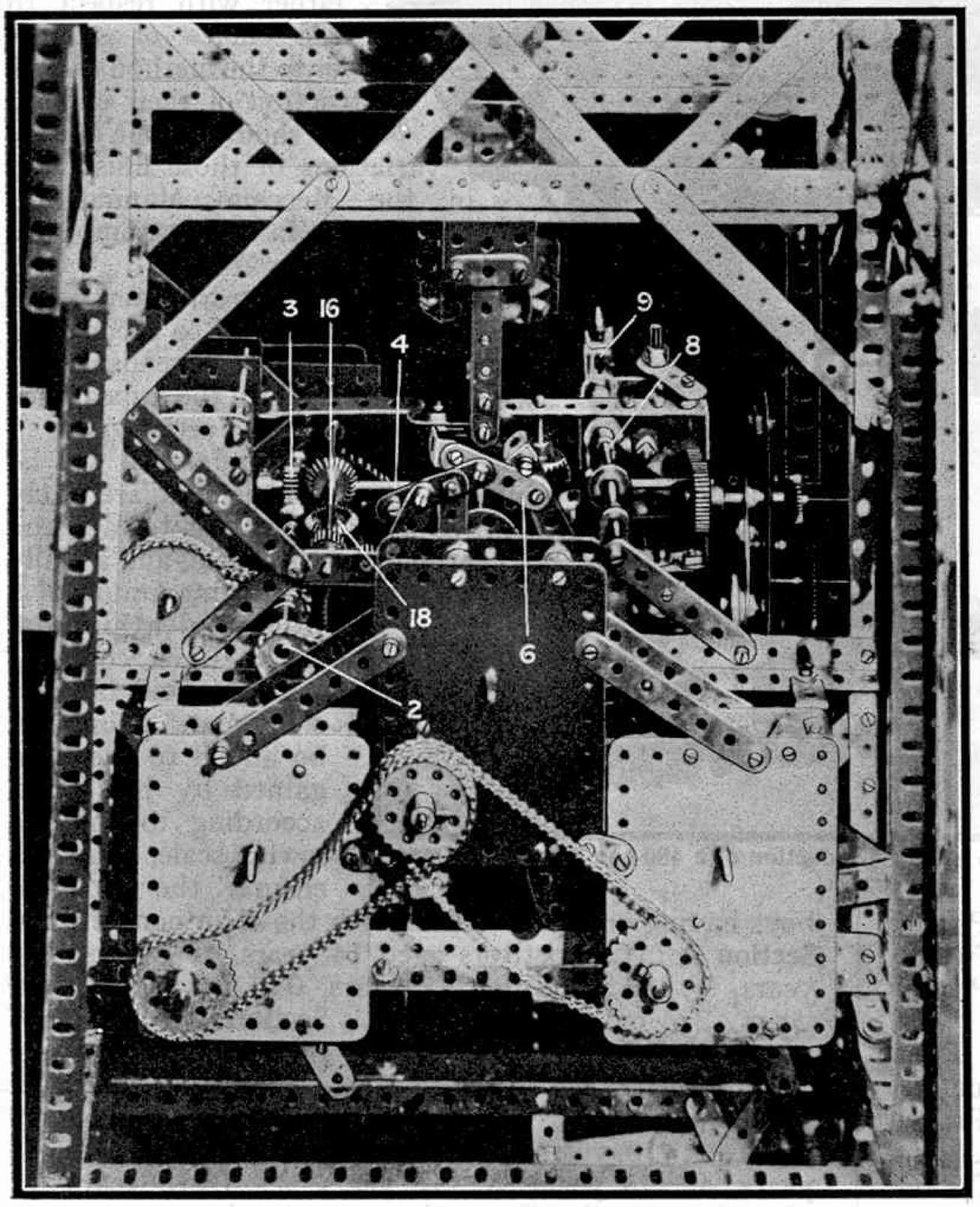


Fig. 3. The mechanism from the "9 o'clock side," showing the driving spindles of the three side Motors linked together by Sprocket gear.

*Since Lt.-Col. Higham built the model the design of the Meccano ½" Pinion has been altered and it now comprises only 19 teeth. Therefore, if the old style Pinions are not available when building the clock, it will be necessary to alter the gearing, or alternatively to adjust the pendulum so that it will beat more rapidly. In any case it will no longer be possible to take the drive for the seconds hand from the first subsidiary axle of the escapement gear train.

which, the moment it is released, starts off in an anti-clockwise direction (as seen in Fig. 4) and in its course strikes against the short tongue 12 that is seen in this view projecting downward from the bottom of the pendulum.

This impact of the escapement wheel upon the tongue gives the pendulum an impulse in the direction of its movement at the time (to the left). Directly it has given its impulse to the pendulum, any further movement of the escapement wheel is prevented by the engagement of its next on-coming tooth with the catch which, together with the trigger mechanism, has meanwhile fallen back into its original situation. Therefore the escapement wheel, after its one jump forward, remains at rest again until the pendulum, in its swinging, once more engages with the trigger.

The same series of events is then repeated for as long as there remains sufficient power in the clockwork, the escapement wheel being permitted to rotate through one-eighth of its circumference at each complete swing of the pendulum which, in turn, is kept in motion by the impulses that it receives. There are thus eight swings of the pendulum for each revolution of the escapement wheel.

When describing the train of gears it was explained that for the minute-hand to revolve once per hour the escapement wheel should revolve $187\frac{1}{2}$ times in that time. The pendulum therefore must swing $8 \times 187\frac{1}{2}$, or 1,500 times per hour, or 25 times every minute, and its length had to be adjusted accordingly. If the pendulum had been of the ordinary type with the details of the escapement at the top, it would have been an easy matter to obtain the right length by timing its swings and either lengthening or shortening it as required. In this pendulum, however, the lowest point is the tongue 12, and that cannot be either raised or lowered, because if it were lowered it would foul the escapement wheel and if raised it would not receive properly its periodic impulses. Hence this pendulum can only be lengthened or shortened from its top end, and to do this the superstructure of the clock has to be opened up and remade each time. This method of construction was adopted deliberately and in spite of this defect, which is comparatively a minor one since it was only felt during the actual process of construction.

In some of the earlier designs the tongue was in fact put higher up and the pendulum extended below it, but it was soon realised that the higher the tongue was the wider the pendulum had to swing for the escapement wheel to clear it. Wider swings need more power, and apart from this the periodic time of a pendulum is, strictly speaking, only constant for relatively short swings. In all the later models, therefore, the tongue was put at the lowest point and the excursions of the pendulum were thus kept as short as possible. After considerable experiment the correct length was found for the pendulum—correct, that is, in the sense that when fitted it caused the clock to run " slow," and when it was diminished by one hole the clock gained. Beyond this point the precise adjustment was made by means of the cage of brass paper-weights to which reference has already been made. Raising or lowering the cage is equivalent to shortening or lengthening the pendulum, and as this movement is controlled by the turning of a screw, it is an easy matter to get the right adjustment and to modify it at any time.

Before proceeding to this last operation, the position of the tongue relative to the escapement wheel was adjusted to a nicety by means of the slotted joint in the shaft of the pendulum already mentioned. Other facilities for accurate adjustment are provided at two points in the escapement, namely (1) in the catch that holds the escapement wheel, and (2) in the lever that works the trigger. Each of these is important and must be made exactly right. If the former does not hold the escapement wheel properly at every tooth but occasionally allows two teeth to slip by, or if the lever does not pull the trigger and release the catch at every

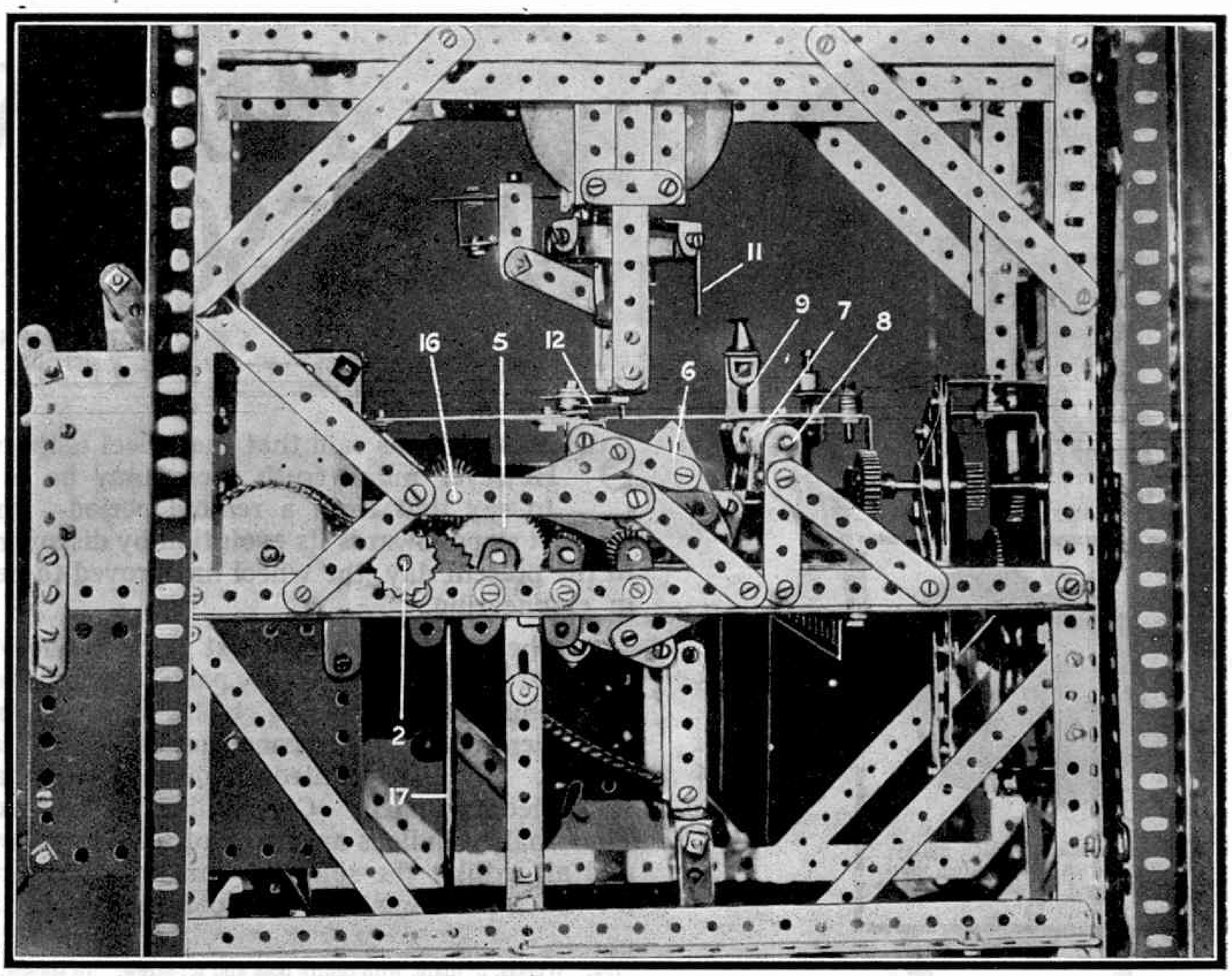


Fig. 4. View of the " 9 o'clock side " of the mechanism with the three side Motors removed.

single swing of the pendulum, the clock will go $2\frac{2}{5}$ seconds fast or slow, as the case may be, at each such occurrence. If this happens only once in a hundred swings an error of a quarter of an hour per day will result!

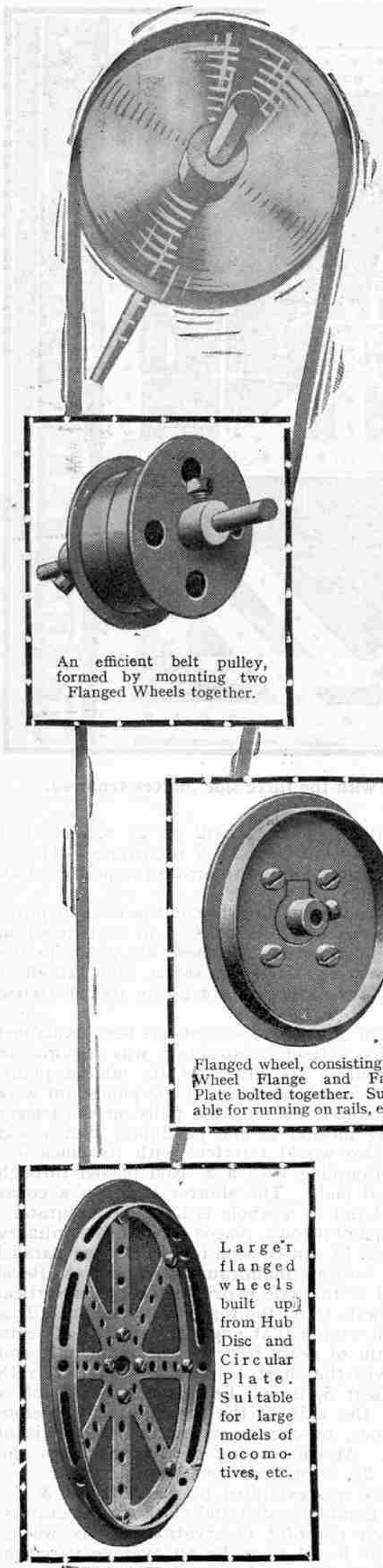
In addition to this up-and-down adjustment the lever requires also adjustment sideways, for upon its position in that direction depends the timing of the impulses. If these are given to the pendulum either too early or too late in its swing, their full effect will not be operative and the clock will not go for its full course at each winding.

Now that the mechanism of the escapement has been explained it will be understood why a rigid construction was required in the pendulum. The impulses are given at its middle point, but the trigger mechanism is to one side. If the pendulum were not rigid the twisting produced by repeated pulls on the trigger would impart a wriggling motion to the pendulum that would be very unsightly and also would interfere with its efficiency.

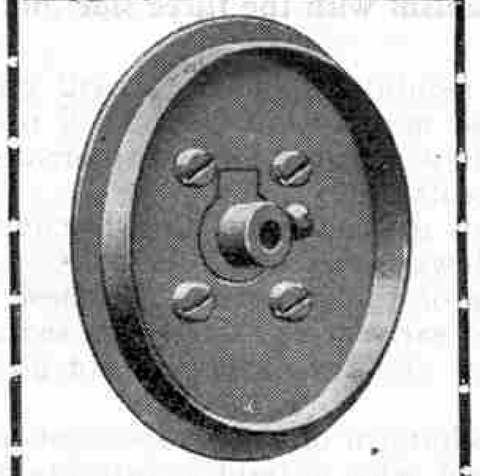
The second-hand is a Coupling with a 2" Rod passed through it so as to leave unequal ends. The shorter end has a collar bolted to it so that the hand as a whole is balanced accurately. This hand revolves on a dial of its own, placed beneath the ordinary face of the clock. Its axle 15 can be seen in Fig. 2 lying parallel to and just below the bottom mainframe member. A Bevel Gear attached to the end of the axle is driven through a vertical shaft 17 (Fig. 4) from an axle 16 on the top of the machine. This latter axle has a 25-teeth Pinion that engages with the 50-teeth Gear Wheel 5 of the train of gears between the main axle and the escapement and drives the shaft 17 through the Bevels 18 (Fig. 3). The axle of Gear 5, it will be remembered, revolves 30 times per hour, and the axle of the second-hand therefore revolves 60 times per hour, or once every minute, which is of course its proper speed. At each swing of the pendulum the seconds hand advances $2\frac{2}{5}$ seconds in one bound.

On completion the clock was exhibited by Favre-Leuba & Co. Limited, the well-known Bombay watch and clock manufacturers, and was kept under their constant observation for six weeks. During that period it was found to make an average variation of only 1 to $1\frac{1}{2}$ minutes per day.

The clock has since been in almost constant operation for six months and has kept reasonably accurate time throughout, which shows that it is of satisfactory design. Nevertheless, changes have suggested themselves, the most important of these being the substitution of weights in place of the Clockwork Motors and a modification to the pendulum in order that a " one second beat " may be obtained. No doubt these alterations will lead to greater accuracy.



An efficient belt pulley, formed by mounting two Flanged Wheels together.



Flanged wheel, consisting of Wheel Flange and Face Plate bolted together. Suitable for running on rails, etc.

Larger flanged wheels built up from Hub Disc and Circular Plate. Suitable for large models of locomotives, etc.

MECCANO ACCESSORY PARTS

3—*WHEELS*

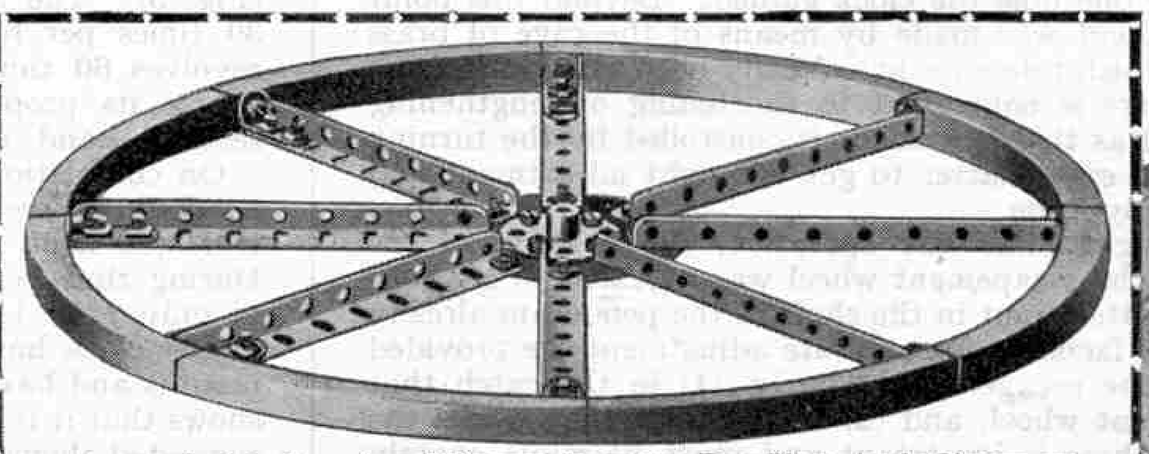
SOMEBODY has said that the wheel is the world's greatest invention. However much truth there may be in this statement it is safe to say that from a remote period—when prehistoric man made the first steps towards its evolution by discovering the use of log rollers—to the present day, the wheel has proved to be one of the greatest assets in engineering.

Wheels take an important place in the Meccano system, of course. There are about 50 accessory parts that may be placed under the category of Wheels, ranging from ½″ to 12″ in diameter, while other parts readily lend themselves to the construction of still larger or different types of wheels. The list printed below contains particulars of a number of such Meccano parts. Gear and other toothed wheels are not included. The smaller pulleys are made of solid brass while the larger are of steel, and all exhibit the splendid finish and perfect accuracy of manufacture for which Meccano parts are noted and appreciated throughout the world.

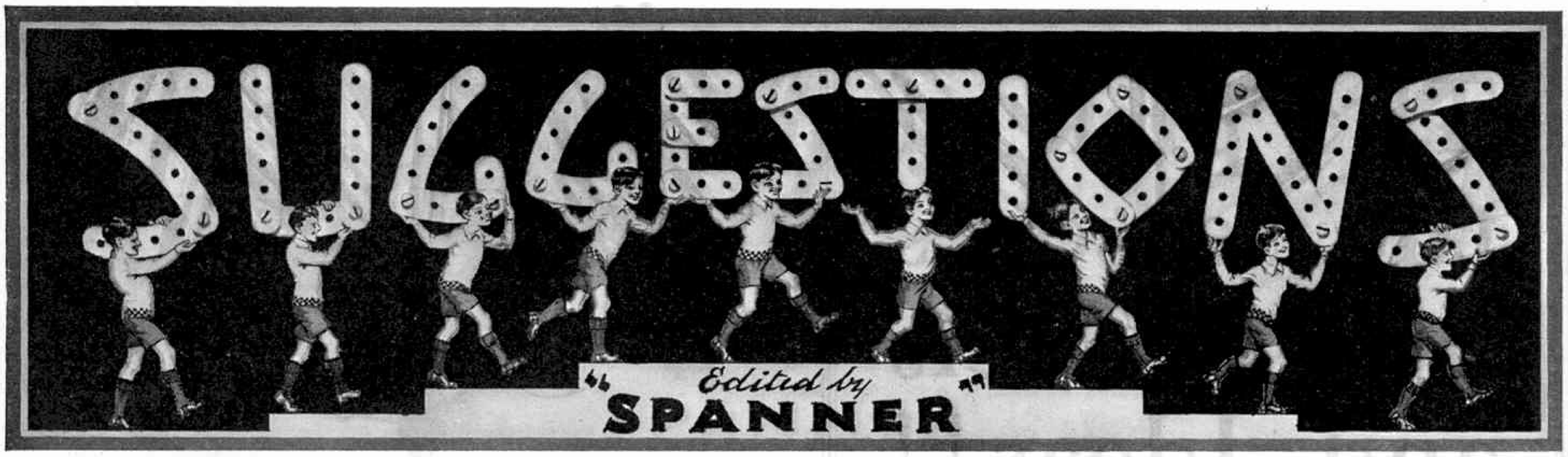
No.		s.	d.
19a.	Wheels, 3″ diam. with centre boss and set-screw. 10 spokes, for use as road-wheels ... each	0	6
20.	Flanged Wheels, 1½″ diam. For use as belt pulleys or rail wheels ... ... ,,	0	5
20b.	,, ,, ¾″ ,, ,, ,, ,, ,, ,, ... ,,	0	4
19b.	Pulley Wheels, 3″ diam. with centre boss and set-screw, V-grooved ... ... ,,	0	7
19c.	,, ,, 6″ ,, ,, ,, ,, ,, ,, ... ,,	2	0
20a.	,, ,, 2″ ,, ,, ,, ,, ,, ,, ... ,,	0	5
21.	,, ,, 1½″ ,, ,, ,, ,, ,, ,, ... ,,	0	4
22.	,, ,, 1″ ,, ,, ,, ,, ,, ,, ... ,,	0	3
22a.	,, ,, 1″ ,, without ,, ,, ,, ,, ... ,,	0	2
23.	,, ,, ½″ ,, ,, ,, ,, ,, ,, ... ,,	0	2
23a.	,, ,, ½″ ,, with ,, ,, ,, ,, ... ,,	0	3
24.	Bush Wheels, 1⅛″ diam., perforated 8 holes ... ... ,,	0	4
109.	Face Plates, 2½″ diam. For use in lathes, etc. Perforated and slotted ... ... ,,	0	4
118.	Hub Discs, 5½″ diam., 8 spokes; outer rim perforated and slotted ... ... ,,	1	3
119.	Channel Segments (8 to circle, 11½″ diam.) Channel section, ½″×½″ ... ... ,,	0	4
123.	Cone Pulleys, 3 V-grooves "in steps," 1½″, 1″, and ¾″ diameters ... ... ,,	1	3
132.	Flywheels, 2¾″ diam. Grooved round circumference and small pulley at centre ... ,,	2	0
137.	Wheel Flanges, 2½″×½″. May be bolted to any of the larger pulleys ... ... ,,	0	3
142.	Rubber Rings (round section). May be used to represent pneumatic tyres ... ... ,,	0	3
142a.	Dunlop Tyres to fit 2″ diam. Pulley Wheels ... ... ,,	0	4½
142b.	,, ,, ,, 3″ ,, ,, ,, ... ,,	0	6
142c.	,, ,, ,, 1″ ,, ,, ,, ... ,,	0	3
142d.	,, ,, ,, 1½″ ,, ,, ,, ... ,,	0	4
143.	Circular Girders, 5½″ diam., L-section. Slotted and perforated ... ... ,,	1	0
145.	Circular Strips, 7½″ diam. over all, perforated ... ... ,,	0	9
146.	Circular Plates, 6″ diam. May be used as flywheels, etc. ... ... ,,	1	0
151.	Pulley Blocks, Single Sheave } ... ... ,,	0	8
152.	,, ,, Two ,, } For use in Cranes, Derricks, etc. ... ... ,,	0	9
153.	,, ,, Three ,, } ... ... ,,	1	0
155.	Rubber Rings ⅝″ (round section) may be used to represent pneumatic tyres ... ,,	0	1
167.	Geared Roller Bearings } The component units of these accessories may be obtained { ... ,,	20	0
168.	Ball Bearings, 4″ diam. } separately. See complete Parts List. { ... ,,	3	0

Your dealer will be pleased to show you all the Meccano Parts. Ask him for a complete list, or write for one direct to

MECCANO LIMITED, OLD SWAN, LIVERPOOL



Large wheel, built up from 8 Channel Segments, Face Plate, Angle Girders, etc. May be used as base for rotating models, or fly-wheel in Beam Engines, and many other purposes. Diameter 11½ ins.



(202)—
Simple Car Steering Gear

(F. Tuke, Haileybury, Ont., Canada)

The steering gear illustrated in Fig. 202, although of extremely simple construction, incorporates the correct Ackermann principle, by means of which the inner road wheel is turned always at a sharper angle than that of the outer wheel when the car travels in a curved line. Perhaps the most interesting feature of the mechanism, however, is the manner in which the movements of the steering wheel are transmitted to the stub-axles.

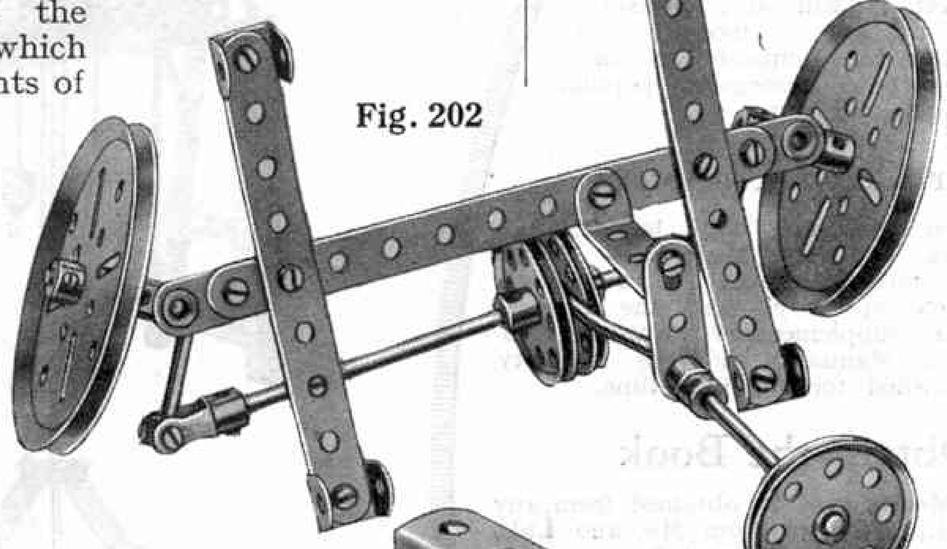


Fig. 202

The steering wheel is secured to a 3½" Crank Handle, the handle portion of which engages between two 1½" Pulleys secured a short distance apart on the "track rod." The latter is attached pivotally by means of Swivel Bearings to the ends of 1½" Rods that are held in the end transverse bores of two Couplings. The Couplings have Pivot Bolts passed loosely through their centre transverse bores and these bolts are inserted in the bosses of Threaded Cranks on each end of the front axle. Lock nuts serve to retain the Pivot Bolts in place.

The road wheels, which are represented by 3" Pulleys, turn freely on 1" Rods held in the longitudinal bores of the Couplings, and they are retained in position by Collars.

(203-4)—
Two Useful Meccano Cams

(N. Ferry, Timperley, and H. Smith, York)

A cam is a device for converting rotary motion into reciprocating motion. In this function it resembles a crank, but unlike the latter it cannot be used to change reciprocating into rotary motion. One of the most common uses to which cams are put and which should be familar to most Meccano boys, is to be found in the operation of the valves of most motor car engines. In effect, a cam is merely a projection on a shaft, matters being arranged so that a lever or the end of a slidable rod rides up and down on the projection as the shaft rotates.

Figs. 203 and 204 show two different types of Meccano cams. The former was designed by N. Ferry and is for use where a regular reciprocating motion is required, while the latter, by H. Smith, is specially adapted to operate the picking motion in a Meccano loom, for which purpose a sharp, quick movement is required in order to throw the shuttle across the slay. This cam is shown actually incorporated in the Meccano Loom (see special Instruction Leaflet No. 16), and we recommend Meccano boys to test its efficiency in place of the cam illustrated in the Leaflet.

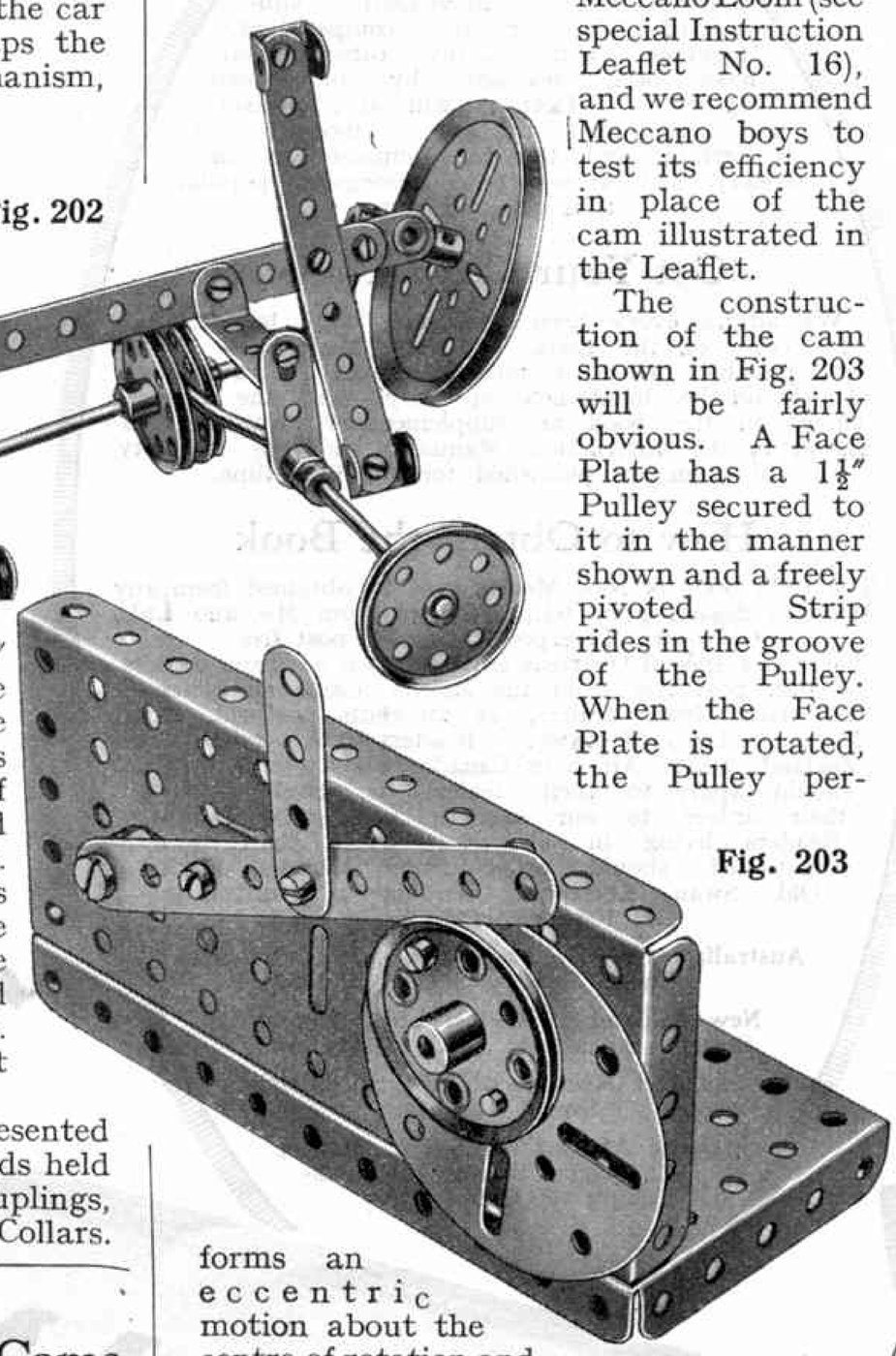


Fig. 203

The construction of the cam shown in Fig. 203 will be fairly obvious. A Face Plate has a 1½" Pulley secured to it in the manner shown and a freely pivoted Strip rides in the groove of the Pulley. When the Face Plate is rotated, the Pulley performs an eccentric motion about the centre of rotation and thus causes the pivoted Strip to rise and fall. The Strip may be connected by Rods or further Strips to the mechanism it is desired to operate.

The second cam consists of two Bush Wheels that are spaced apart by three Collars and joined together by as many ⅜" Bolts, which are passed through the Collars. The rocker arm is a 5½" Strip, pivoted on a bolt at one end and secured at the other end to a 2½" Flat Girder, which bears on the Collars. A vertical Rod transmits the motion of the rocker arm to the picking sticks of the loom.

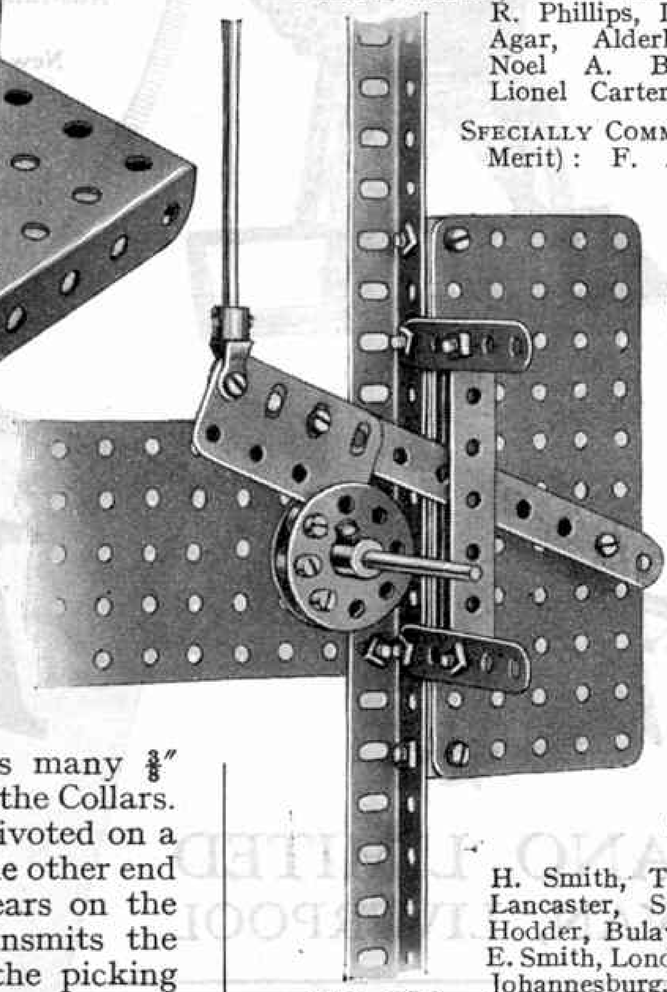


Fig. 204

Reversing Truck Contest

The numerous entries received in the Automatic Reversing Truck Contest provide further evidence of the world-wide interest aroused by the "Mystery Model" Contests that we are able to announce from time to time. It will be recalled that Meccano boys were asked to explain the reason why a truck propelled by a Clockwork Motor persisted in travelling always in the direction in which it was first pushed.

Our own solution to the problem consisted in mounting one pair of road wheels on a Crankshaft, and coupling the latter by a connecting rod to a Bush Wheel or Crank on the driving spindle of the Motor. Many competitors adopted the same method, and thereby qualified for the principal prize offered in each Section. Consequently we were obliged to divide the prizes amongst several competitors, as shown in the list below.

Many ingenious alternative solutions were put forward, and of these the entries from W. F. F. Kemsley and T. C. Lees must be specially commended. Indeed, although their solutions are much more complicated than the official one, the judges are of the opinion that they obtained the required results in a more scientific manner.

Section A (Home) :—

FIRST PRIZE divided amongst the following eight competitors, each receiving Meccano products to value 3/-: W. Raybould, Jr., Walsall, Staffs.; R. H. Maynard, Luton, Beds.; James F. Huson, London, S.E.19; T. L. Nelson, Sherborne, Dorset; R. Phillips, London, E.4; W. O. Agar, Alderley Edge, Cheshire; Noel A. Brampton, Daventry; Lionel Carter, Corsham, Wilts.

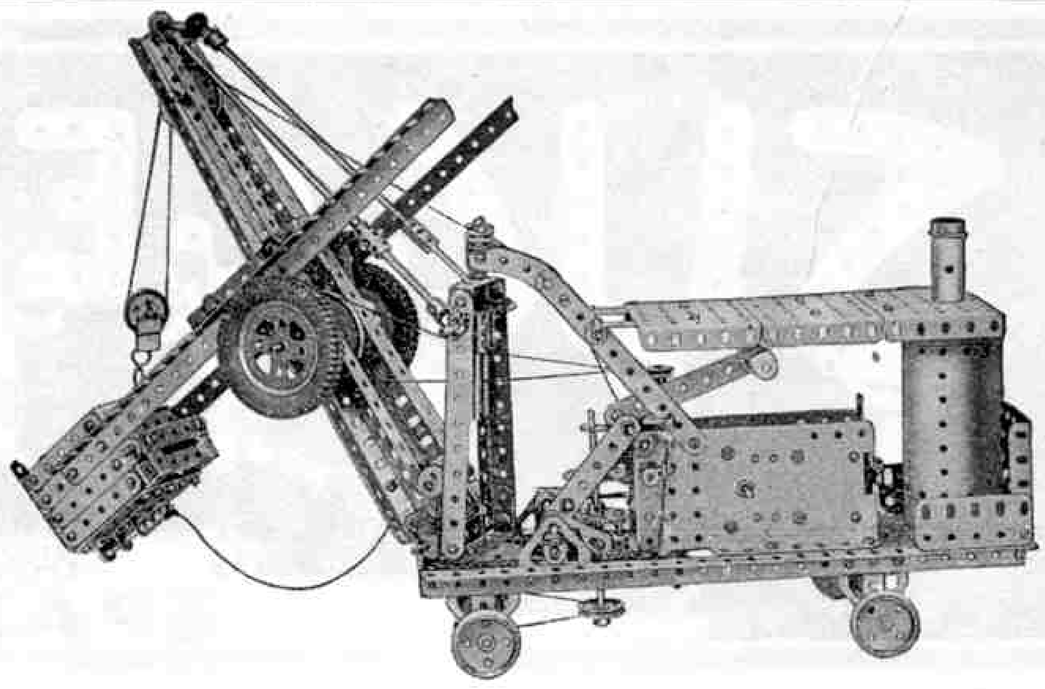
SPECIALLY COMMENDED (Certificates of Merit): F. A. Burt, Erdington; T. C. Lees, Seaford, Sussex; W. F. F. Kemsley, Cheriton, Folkestone.

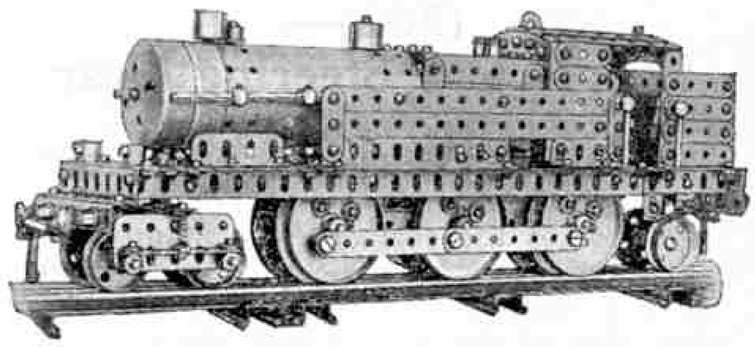
Section B (Overseas) :—

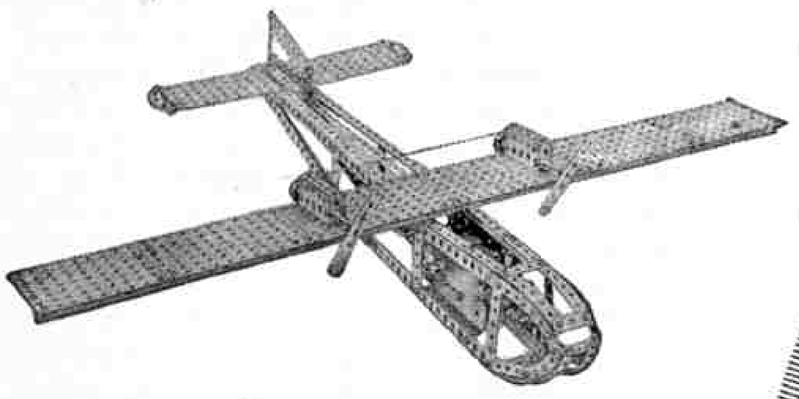
FIRST PRIZE divided amongst the following six competitors, each receiving Meccano products to value 3/6: Eric Meek, Wellington, N.Z.; John A. Head, Galt, Ontario, Canada; Lawton Westrom, Veteran, Alberta, Canada; F. Lyons, Montreal, Canada; F. Johnson, Durban, South Africa; W. Richardson, Christchurch, N.Z.

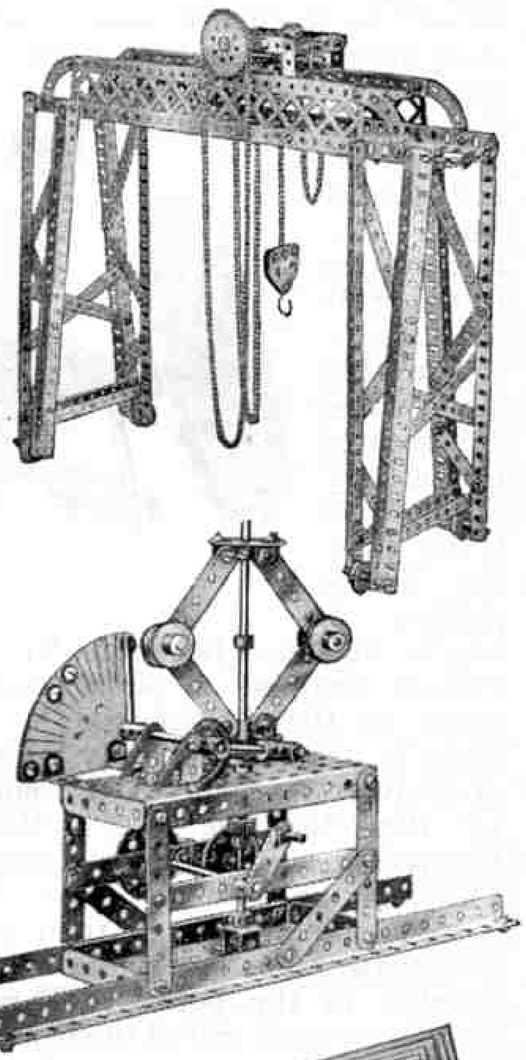
SPECIALLY COMMENDED (Certificate of Merit): H. Smith, Toronto, Canada; L. Lancaster, Sydney, Australia; H. Hodder, Bulawayo, Rhodesia, S.A.; E. Smith, London, Canada; L. Harris, Johannesburg, S.A.; P. D. Stewart, Melbourne, Australia.

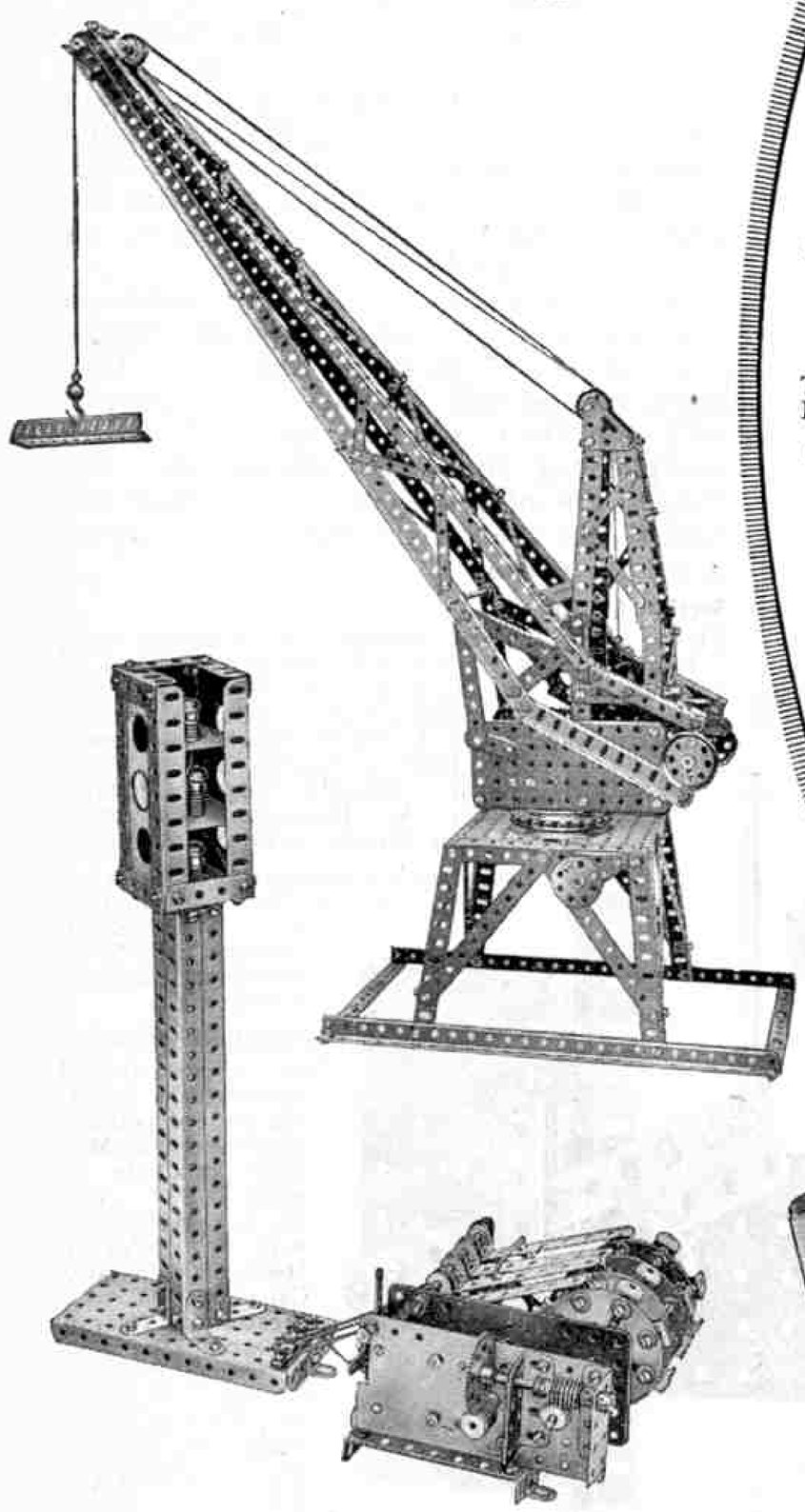
The pick of the season's new Models and Ideas!!











THE MECCANO BOOK OF NEW MODELS contains illustrations and details of the best of the models and movements submitted in recent competitions, together with many others that have been designed by our own experts. That it will give pleasure and enjoyment to every model-builder is certain, and the big demand we have already had shows how immensely popular it is amongst boys.

Get Your Copy To-day

We advise every keen Meccano boy to obtain his copy of the Book of New Models as early as possible, while a plentiful supply is available. It should be mentioned specially that the models shown in the book are supplementary to the models shown in the Instruction Manuals, and the majority of them are published for the first time.

How to Obtain the Book

The 1930 Book of New Models may be obtained from any Meccano dealer, price 6d., or direct from Meccano Ltd., Old Swan, Liverpool, price 7d. post free.

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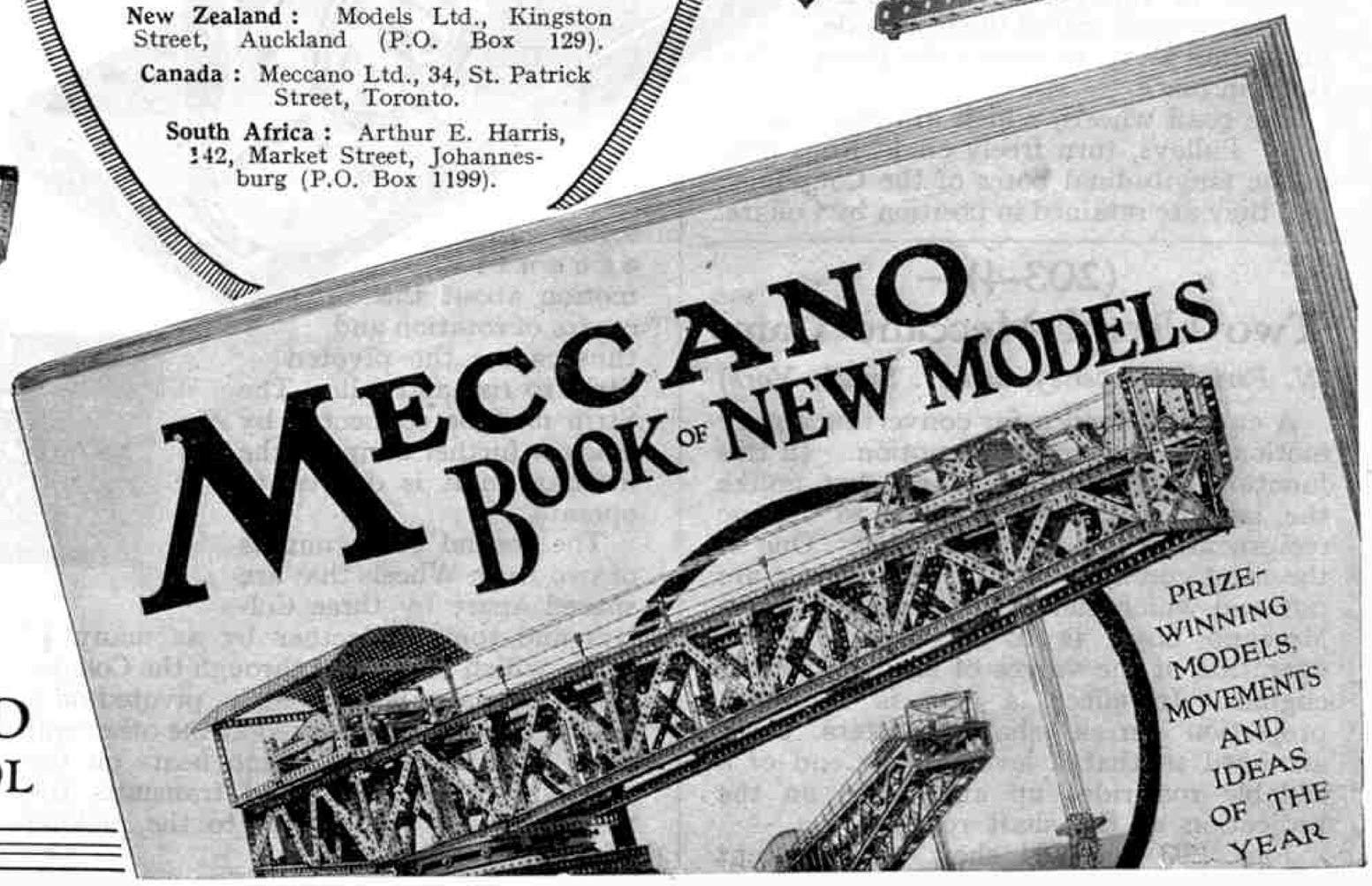
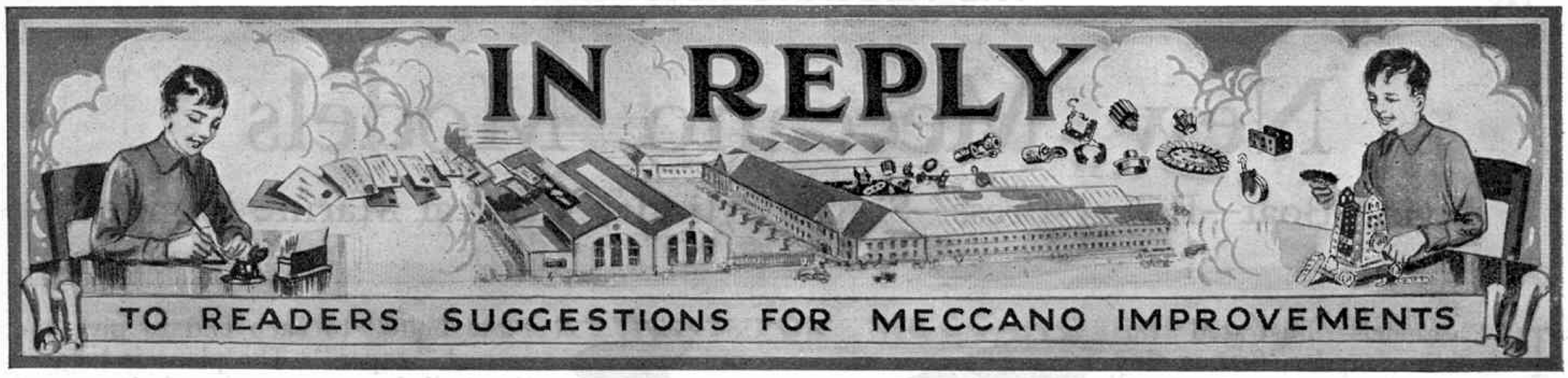
Canada : Meccano Ltd., 34, St. Patrick Street, Toronto.

South Africa : Arthur E. Harris, 142, Market Street, Johannesburg (P.O. Box 1199).

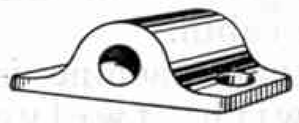


MECCANO LIMITED
OLD SWAN, LIVERPOOL



In this page, month by month, we reply to suggestions regarding improvements or additions to the Meccano system. We receive many hundreds of these suggestions every week, and consequently we are able to publish only ideas that show particular interest or ingenuity. Suggestions submitted for consideration in this section must be written on a separate sheet of paper and the name and address of the sender must appear on each sheet used. Envelopes should be addressed to "Suggestions," Meccano Ltd., Binns Road, Old Swan, Liverpool.

ROD BEARING.—We have inspected your design for a special rod bearing (see accompanying sketch) which you suggest should be introduced to the Meccano system. As will be seen the part would comprise a semi-circular piece of metal fitted with two drilled projecting lugs. A standard size hole would be drilled through the bearing so that Axle Rods could rotate freely in it. This part might be of some use for supporting long rotating shafts in large models, but there is no need for us to introduce a special accessory of this kind as the Meccano Handrail Support (part No. 136) fulfils the above function admirably. The ordinary or Double Arm Cranks, when suitably mounted, are also useful as shafting supports. (*Reply to L. Ross, Stamford Hill*).



BALL JOINT.—We were interested in your suggestion that a ball joint connection unit should be introduced. This would be quite useful in the construction of scientific models where a mirror or other part has to be mounted so that it can be adjusted in any direction. It is quite a simple matter to improvise a suitable mounting, however, by using the Meccano Universal Joint and other parts, and we do not consider the introduction of your suggested part necessary. (*Reply to J. S. Hawker, Toronto, Canada*).

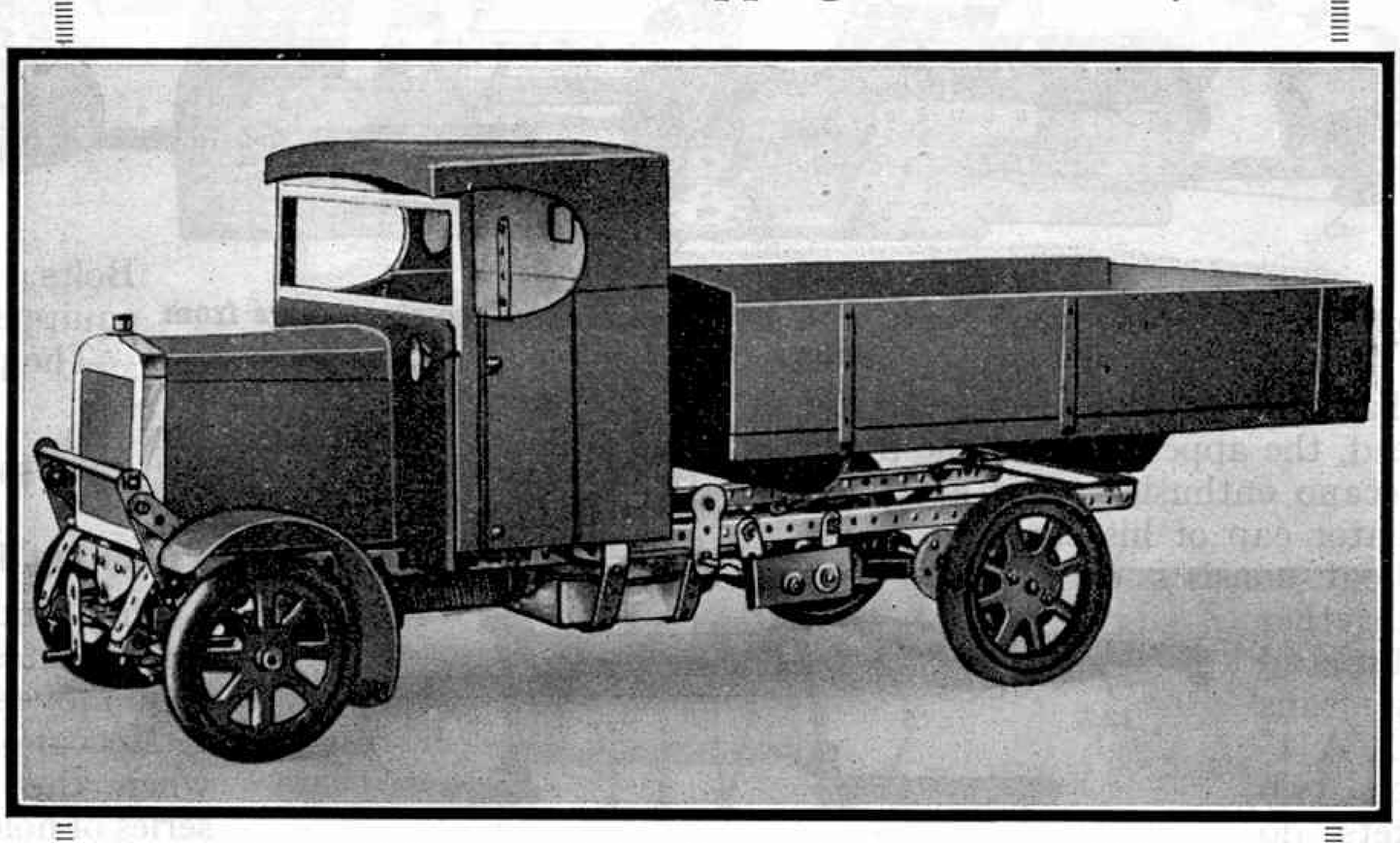
5½" × 5½" PLATE.—A plate of this size would be very clumsy in use and could only be employed in the larger models. You will find it a much better plan to build up this size of plate from existing Flat Plates in the few instances when required. Plates three holes wide also are unnecessary additions, as two Flat Girders bolted together will serve the purpose equally well. Your idea that the Clockwork Motor should incorporate an integral gear box is quite interesting, but the fitting of a two or three-speed gear box would raise the cost of the complete Motor considerably. In addition there is great pleasure and instruction to be obtained in the building of a gear box from standard Meccano Gears, Pinions, and Rods, etc., which would be altogether absent if the gear box were specially manufactured. (*Reply to F. Clinton, Durban, S. Africa*).

WHEEL DISCS.—Aluminium wheel discs suitable for fitting to the 3" and 2" diam. Pulleys in model motors, etc., would not be suitable additions to the Meccano range as they would be purely ornamental and would serve little, if any, useful purpose. You should have little difficulty in preparing suitable discs for your models by cutting them out of cardboard and afterwards covering them with silver paper or tinfoil to represent aluminium. Your suggestion regarding a special clutch withdrawal pedal is interesting, but we think the standard Meccano clutch satisfactory for the purpose. (*Reply to F. Simpson, Adelaide, S. Australia*).

6 B.A. ROD.—We note your suggestion that lengths of 6 B.A. screwed brass rod or "studding" should be introduced. It would not be advisable to do this, however, as very few uses could be found for the material in general constructional work. (*Reply to H. Berry, Cambridge*).

WORM AND WORM WHEEL.—Your idea that we should produce a reversible worm drive unit has possibilities. The unit would comprise, we understand, a worm having special "curved" threads and a worm wheel with teeth to mesh with the threads of the worm, both worm and worm wheel being bored and fitted with standard tapped bosses, so that they might be secured on Meccano Rods. A unit of this type would provide a slightly more efficient reduction gear than one built up from the existing Worm meshed with any of the range of Meccano Gears and Pinions, but your proposed unit would have a much more restricted use than the existing Worm mechanism, for the shape of the teeth would not allow the special parts to mesh with any of the Meccano Gears or Pinions. We are not losing sight of this idea, however, and may be able to reconsider it later. (*Reply to R. Jouvenel, Villefranche, Rhone, France*).

A Fine Meccano Tipping Motor Lorry



This excellent model of a commercial tipping lorry was built by R. Holmes, of Huddersfield, and gained a prize in a Meccano Model-building Contest. It is driven by an Electric Motor and is fitted with a clutch and three-speed and reverse gear box. The body is tipped by means of an ingenious screw mechanism.

IMPROVED STRIP COUPLING.—The sample of your proposed new accessory which you have submitted for our inspection is very ingenious, and we congratulate you on your mechanical skill. The accessory would somewhat resemble a Meccano Strip Coupling (part No. 63b) but two extra slots would be cut in it to permit Strips to be attached in a wider variety of positions. Quite a number of uses could be found for a part of this type in general model-building, but we doubt whether the advantages would be sufficient to warrant the cost of manufacture. (*Reply to R. Beauchamp, Poitiers, Vienne, France*).

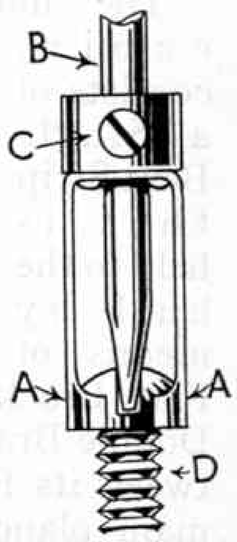
RELEASE MECHANISM FOR GRAB.—We were interested in your proposed design for a release gear for controlling the movement of the jaws of a grab on the single-suspension principle, i.e. by using one cord for the dual purpose of suspending the grab and controlling its jaws. This gear would no doubt function quite well, but an efficient gear of this type may be made from standard parts (see "Suggestions Section" for January, 1930). (*Reply to A. Danel, Lille, France*).

HEAD LAMP REFLECTORS.—We have noted your suggestion regarding the manufacture of reflectors that could be used in conjunction with the Meccano Lamp Holder and Lamp to form motor car headlamps, searchlights, etc., and certainly consider this quite a good idea. We hope to give it further attention in the near future and in the meantime we would suggest you improvise a reflector from a small hollow cone made from cardboard and covered inside with "silver paper." (*Reply to M. Deyris, Boufarik, Algeria*).

IMPROVED CLOCKWORK MOTOR.—We note your suggestion that the Clockwork Motor should be altered so that the driving shaft runs at higher speed. It is hardly necessary to do this, however, for by coupling the shaft to a secondary shaft journalled in the Motor side plates by means of "step-up" gearing, an increase of speed can easily be obtained. The weight of the existing Motor could not be reduced to any great extent without impairing its efficiency. Tubes for cannons have been suggested before, but are unsuitable for the Meccano system. Axle Rods, Couplings, or Angle Girders may be used to represent gun barrels according to the size of the model. (*Reply to R. P. Jones, Wigan*).

SPECIAL ROD CONNECTION.—We were interested in your proposal that the ends of the standard Axle Rods should be alternately slotted and "spigoted" so that the Rods might be joined together. The connection resulting from this scheme would not be at all satisfactory, however, and the cutting of the Rods as you suggest would increase the cost of the parts considerably. You will find it a much better plan to use a standard Meccano Coupling when two Rods are to be secured rigidly together. (*Reply to L. Machaux, St. Denis, France*).

ANOTHER "NON-SLIP" DEVICE.—The accompanying illustration shows another interesting scheme for preventing the blade of the screwdriver from slipping off the heads of the bolts, when the latter are being rotated. As shown in the sketch, the fitting would consist of a boss C to which would be riveted two arms A shaped at their extremities to semicircular section so that they would fit round the head of a standard bolt D. The complete fitting would be slipped on to the blade of a screwdriver and locked in place by means of a grub-screw in the boss C. This device is certainly very interesting and would no doubt go a long way in overcoming the slipping trouble and we may be able to consider the scheme more fully in the future. In the meantime model-builders can experiment with this idea for themselves by using a Meccano Small Fork Piece and bending the "forks" so that they conform to the shape of the arms A in the sketch. (*Reply to E. Gordon, Sheffield and H. W. Dixon, Crosby*).



New Meccano Models

Flying Boat—Power Press—Single Cylinder Vertical Marine Engine

THE models illustrated this month comprise, first, a tiny model of the Dornier Do.X flying boat; second, a model power press that works on very similar lines to the huge presses used in the Meccano factory; and third, a fine reproduction of a single cylinder vertical marine engine. The last-named model will appeal particularly to the student of steam engine design, for the working of the piston valve control gear, and pump action can be followed very clearly when the crankshaft is rotated.

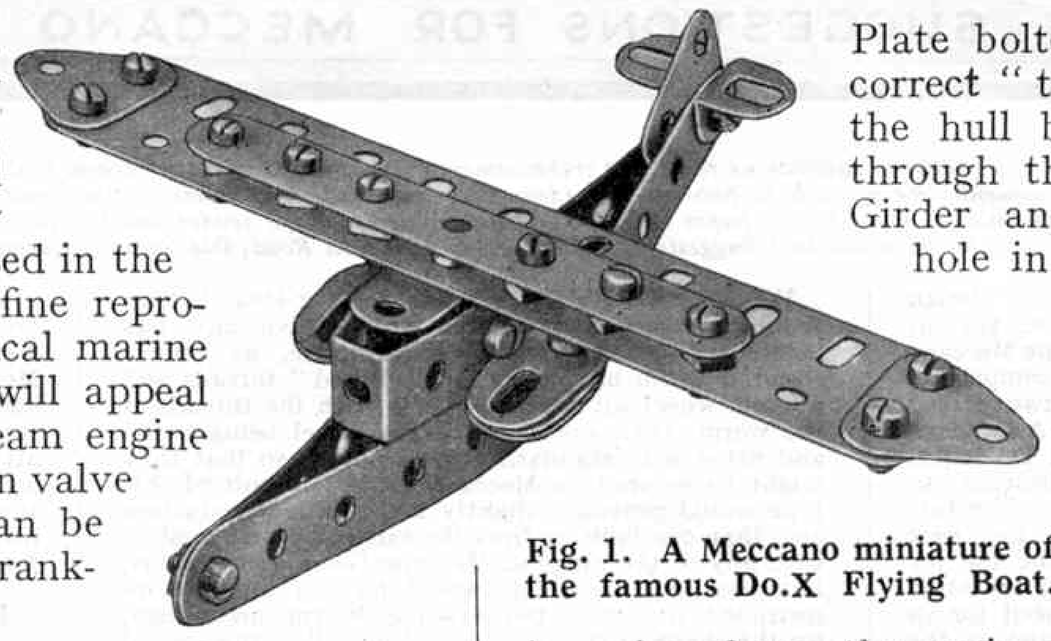


Fig. 1. A Meccano miniature of the famous Do.X Flying Boat.

A Unique Flying Boat

Every Meccano boy will have read about the great German flying boat, the Dornier Do.X, which was completed last year, and no doubt many have wished to build a model of it. That a realistic reproduction of this colossal "water bird" need not be very elaborate is proved by the tiny model of the machine shown in Fig. 1. A most realistic result has been achieved with the use of very few parts. Indeed, the appearance of the model is so neat that one Meccano enthusiast uses a replica as a mascot for the radiator cap of his car!

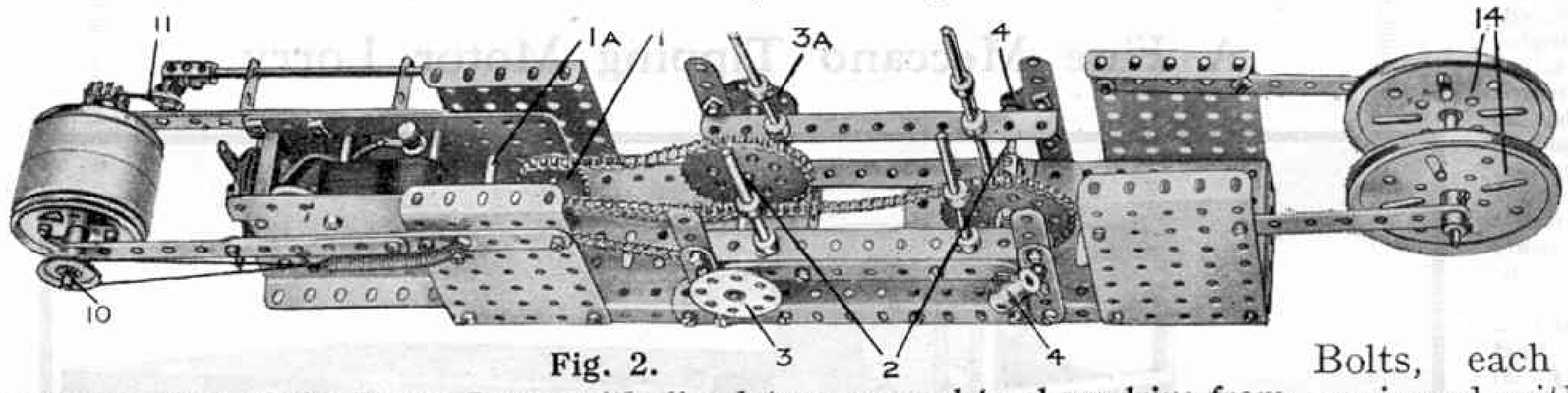


Fig. 2. Semi-plan view of the Power Press, with die platen removed to show drive from Motor.

The hull of the boat consists of two $5\frac{1}{2}$" Curved Strips bolted together at prow and stern and spaced apart at the centre by means of a Double Bracket. A 1" Triangular Plate and two $\frac{1}{2}" \times \frac{1}{2}"$ Angle Brackets do duty for rudder and tail plane respectively. Three Flat Brackets are attached by means of $\frac{1}{2}" \times \frac{1}{2}"$ Angle Brackets to each side of the centre portion of the hull to form the "stabilising pontoons."

The hull superstructure, or cabin, consists of a Single Bent Strip that is held to the hull by means of Flat Brackets and has a Double Bracket bolted between its free ends. The main plane is a $5\frac{1}{2}$" Flat Girder with a 1" Triangular Plate bolted to each end to give the correct "taper." The plane is held to the hull by means of a bolt passed through the centre round hole in the Girder and also through the centre hole in the Double Bracket that is secured to the Single Bent Strip. A Flat Bracket also is placed on this bolt as shown, to fill in the top of the cabin.

The actual machine is fitted with twelve "Jupiter" engines placed in pairs above the main plane, the front set driving "tractor" airscrews while the rear engines rotate "pusher" type airscrews. Each duplex engine nacelle is connected by an auxiliary plane, which extends over the centre portion of the main plane, and this auxiliary plane has been represented in the model by a $3\frac{1}{2}$" Strip supported above the $5\frac{1}{2}$" Flat Girder by $\frac{3}{8}$" Bolts, each of which is equipped with three nuts.

The parts required to build the model are as follows:—

1 of No. 3; 9 of No. 10; 2 of No. 11; 4 of No. 12; 13 of No. 37; 18 of No. 37A; 3 of No. 77; 2 of No. 80; 1 of No. 102; 1 of No. 103; 6 of No. 111c.

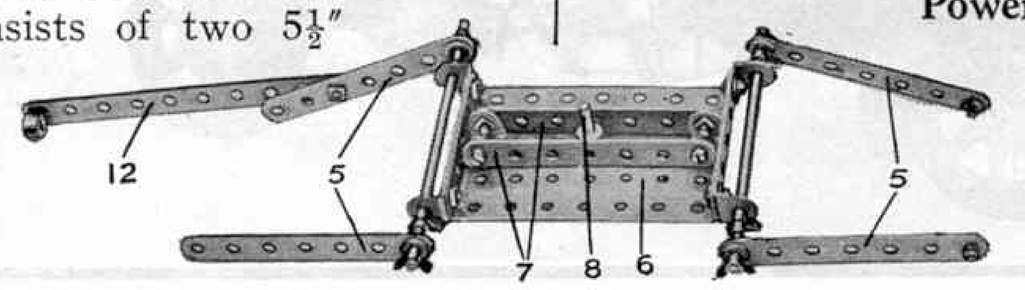


Fig 3. The die platen of the Power Press, with ratchet feed link (12) attached.

Power Punching Press

The model shown in Fig. 4 incorporates several novel Meccano movements. It is driven by a Meccano Electric Motor and when this is set in motion, a series of holes are punched rapidly and clearly on a strip of paper that is fed intermittently from the supply drum on to the "take-up" barrel. The platen in which the die or punch is fitted is oscillated with great rapidity in a vertical direction by means of cranks, while the take-up barrel is rotated at the right moment by an ingenious ratchet mechanism.

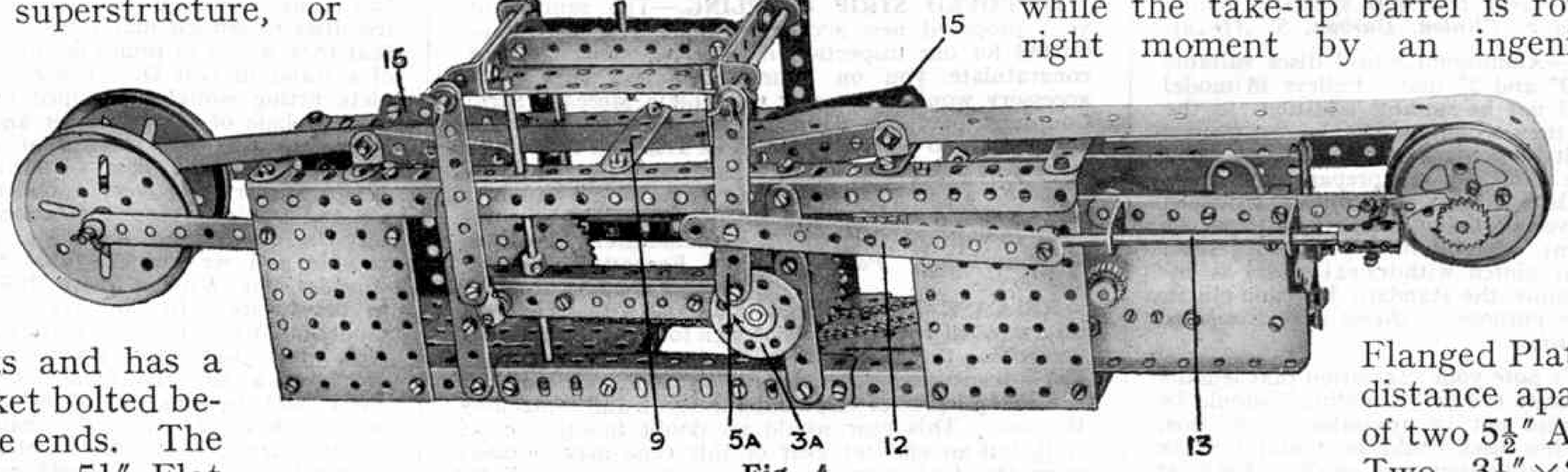


Fig. 4. General view of Power Press, showing paper strip in position.

The bed or frame of the press is built up from two $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plates held some distance apart by means of two $5\frac{1}{2}"$ Angle Girders. Two $3\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plates are bolted to each

of the $5\frac{1}{2}$" Flanged Plates as shown and a Meccano Electric Motor is secured in position on the base. Two $5\frac{1}{2}$" Strips are attached to the right-hand pair of $3\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plates (see Fig. 2) to form journals for the axle that carries the supply drum, and further $5\frac{1}{2}$" Strips are bolted to one of the left-hand side plates and to the Electric Motor to form supports for the take-up barrel shaft.

The drive from the Electric Motor is transmitted via the $\frac{1}{2}$" Pinion on the armature shaft to a 57-teeth Gear on the Rod 1a (Fig. 2) and from another $\frac{1}{2}$" Pinion on this Rod to a second 57-teeth Gear on the Rod 1. Two 1" Sprocket Wheels on the latter Rod are connected by Sprocket Chain to 2" Sprocket Wheels on the "crankshafts" 2. One crankshaft is formed from a $3\frac{1}{2}$" Rod and two Bush Wheels 3 and 3a, and the other from a $3\frac{1}{2}$" Rod carrying two Couplings 4 placed at exactly similar angles. Four Strips 5, which form connecting links between the die platen 6 and the crankshafts, are lock-nutted to the Bush Wheels and attached pivotally to the Couplings by $\frac{3}{8}$" Bolts. They are pivoted to the die platen by means of two $4\frac{1}{2}$" Rods and retained in place by Spring Clips.

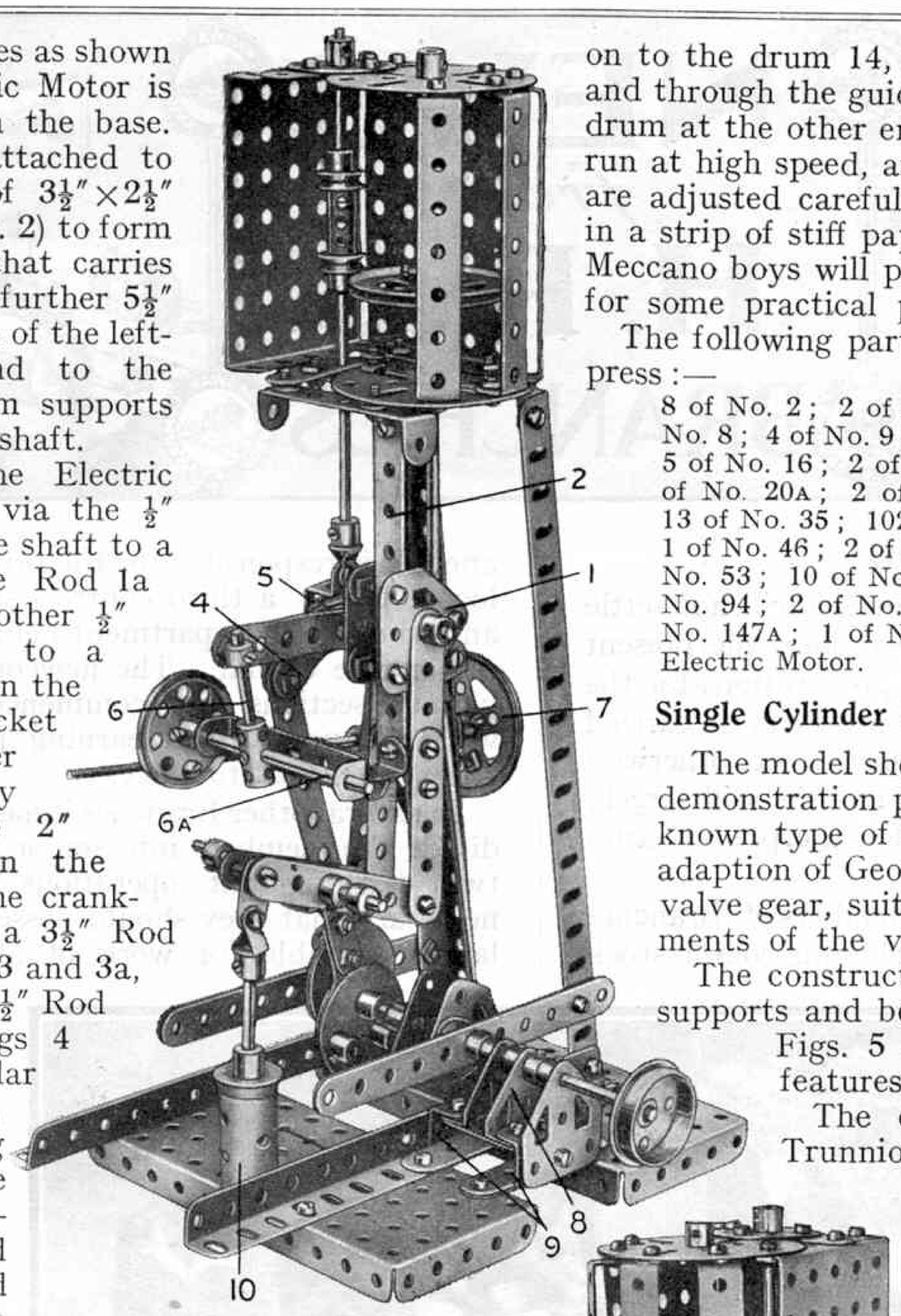


Fig. 5.
The Vertical Marine Engine partly dismantled to show valve mechanism and feed pump.

The die platen is shown in Fig. 3. The $3\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate forming the platen is strengthened with two $3\frac{1}{2}$" Strips 7 bolted to the Plate by Double Brackets, and the die 8 (a $1\frac{1}{2}$" Rod) is secured rigidly to the platen by means of a Crank. Two $2\frac{1}{2}$" Strips 9 bolted to the frame of the model and spaced apart by Washers form the "sink," through which passes the paper strip. Guides 15 are provided to keep the material in correct alignment.

The feed drum is composed of two Boiler Ends attached to the Rod 10 by means of two 2" Pulleys. At one end of this Rod is affixed a 1" Pulley on which works a spring-controlled brake, and on the other end is attached a Ratchet Wheel that engages with a Pawl 11, which is retained in constant engagement by means of a piece of Spring Cord or elastic. The Pawl is attached to a $4\frac{1}{2}$" Rod 13 by means of a Coupling and the Rod is connected pivotally by a $5\frac{1}{2}$" Strip 12 to the Strip 5a.

The arrow marked on the Bush Wheel 3a in Fig. 4 shows the direction of travel, which is very important, for the feed drum must only turn when the die platen is at the top of its stroke. The paper to be punched is first wound on to the drum 14, then passed through the guides 15 and through the guide 9 and its end is stuck to the feed drum at the other end of the model. The press may be run at high speed, and provided that the working parts are adjusted carefully, it will punch neat round holes in a strip of stiff paper with a high degree of accuracy. Meccano boys will perhaps be able to utilise this model for some practical purpose.

The following parts are necessary to build the power press:—

8 of No. 2; 2 of No. 2A; 6 of No. 3; 18 of No. 5; 2 of No. 8; 4 of No. 9; 2 of No. 11; 1 of No. 15; 5 of No. 15A; 5 of No. 16; 2 of No. 17; 1 of No. 18A; 2 of No. 19B; 2 of No. 20A; 2 of No. 24; 1 of No. 26; 2 of No. 27A; 13 of No. 35; 102 of No. 37; 19 of No. 38; 1 of No. 43; 1 of No. 46; 2 of No. 48; 2 of No. 48A; 2 of No. 52; 5 of No. 53; 10 of No. 59; 1 of No. 62; 3 of No. 63; 30" of No. 94; 2 of No. 95; 2 of No. 96; 2 of No. 111c; 1 of No. 147A; 1 of No. 147B; 1 of No. 148; 2 of No. 162A; Electric Motor.

Single Cylinder Marine Engine

The model shown in Figs. 5 and 6 is excellent for demonstration purposes. It is modelled on a well-known type of marine engine and incorporates an adaption of George Stephenson's famous locomotive valve gear, suitably modified to meet the requirements of the vertically placed cylinder.

The construction of the cylinder block, cylinder supports and bed of the engine will be clear from Figs. 5 and 6 and only the mechanical features require explanation.

The crosshead 1 consists of two Flat Trunnions secured together by two Double Brackets, which are free to slide between two $4\frac{1}{2}$" Strips 2 forming the crosshead guide. The latter is attached at its upper extremity to a $\frac{1}{2}" \times \frac{1}{2}"$ Angle Bracket on the bottom cylinder cover, and at its lower extremity to a $\frac{1}{2}" \times \frac{1}{2}"$ Angle Bracket that is mounted on a Trunnion. The Strips of the guide are spaced apart by a Washer on each of the retaining bolts. A Coupling is secured rigidly to the apex of the crosshead by bolts inserted in its upper transverse tapped bore. This Coupling is secured also to the piston rod, and is attached pivotally to the connecting rod by a Fork Piece that rides on two bolts inserted in its lower transverse tapped bore.

The crankshaft is built up from two Rods on the inner ends of which Cranks are secured very rigidly. The crank pin is a $\frac{3}{4}$" Bolt, which is fixed rigidly by nuts in the end holes of the Cranks, and in Flat Trunnions that form the balance weights. The "big

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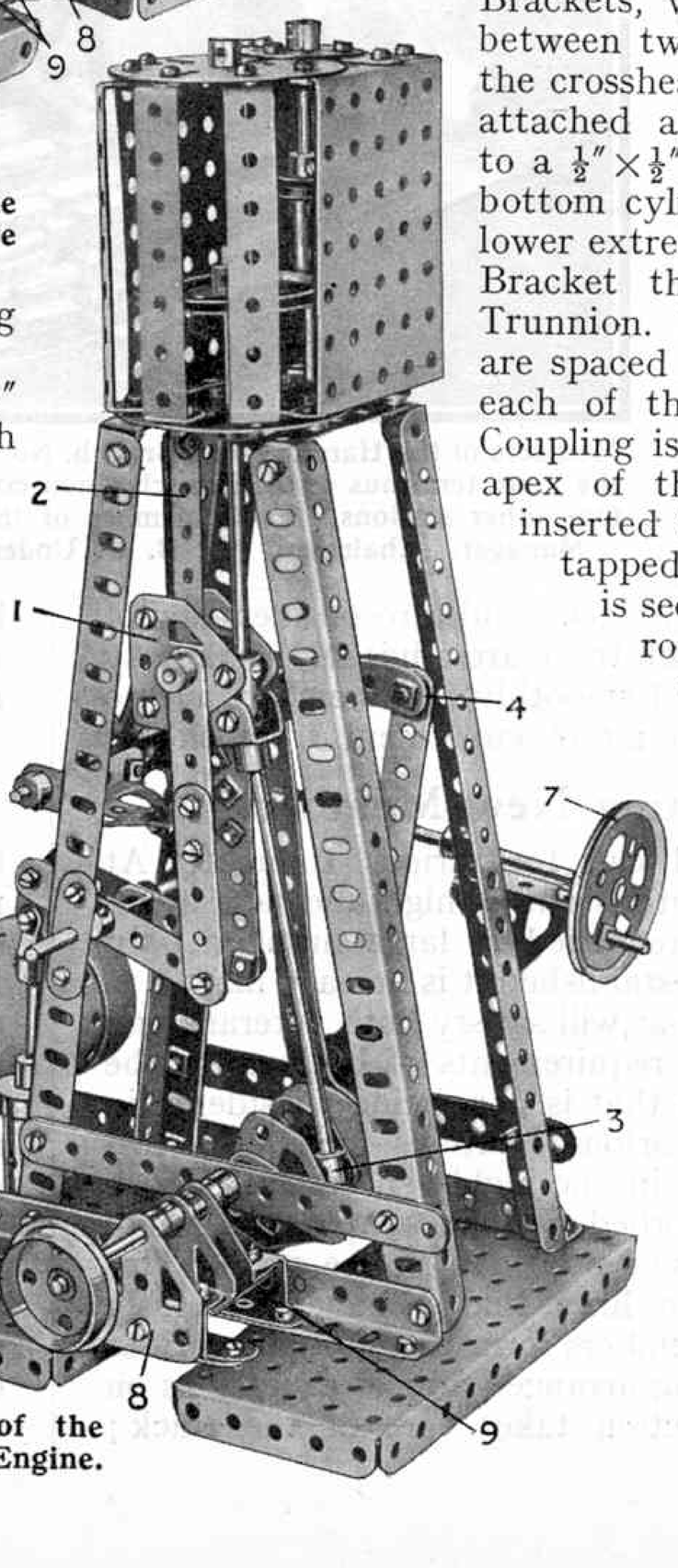
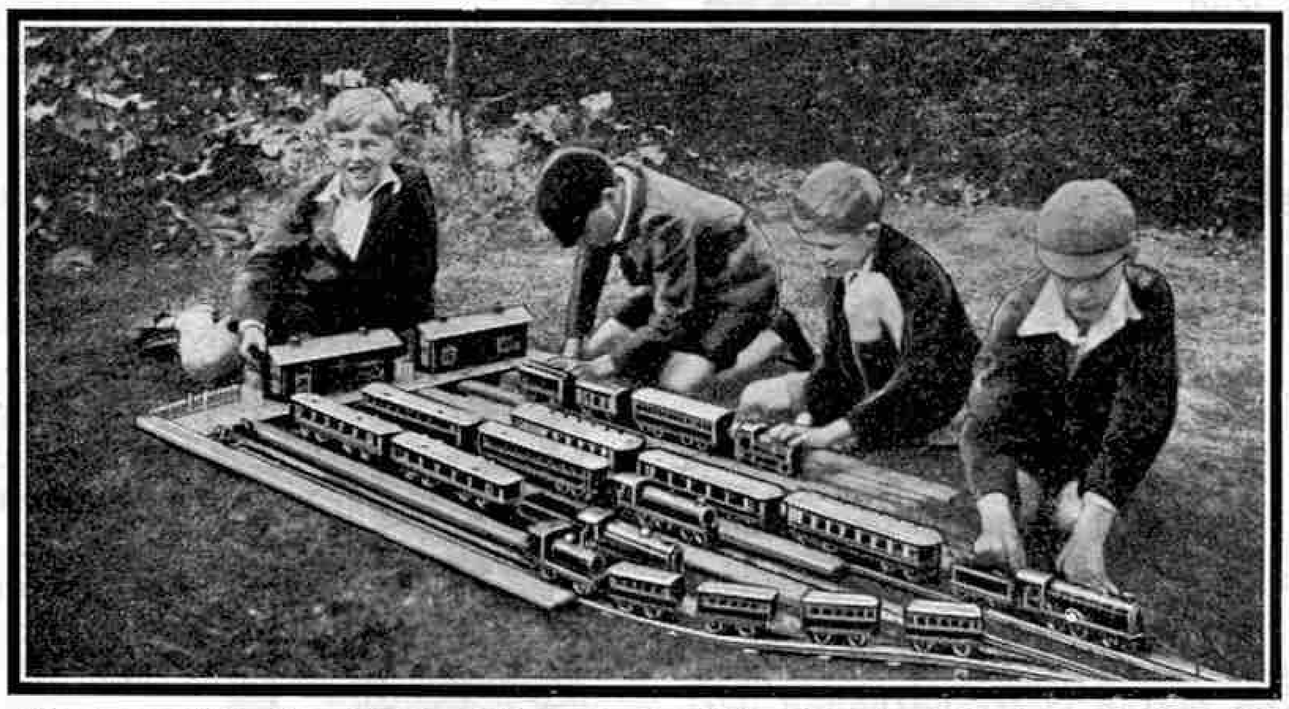


Fig. 6.
General view of the Vertical Marine Engine.

Looking Ahead

Although the majority of the Branches will not settle down to serious indoor work until October, the present month is a good time to commence preparations for the winter sessions. Much really useful work can be carried out during September, and the success or otherwise of the Branch during the next few months will largely be determined by the care with which the preliminaries are carried out.

Among the tasks that await the members of Branches at this time of the year, that of overhauling rolling stock and planning the layouts to be used indoors probably will have the greatest attraction for the majority. The reports I have received during recent months have shown that in very few instances has track work been neglected during the summer. Even in those instances where an outdoor layout could not be constructed, regular meetings indoors have been arranged, and thus the work of preparation is lighter than otherwise would have been the case. Nevertheless a careful overhaul of rolling stock and a reconsideration of the layout of the Branch track are advisable if railway operations are to proceed smoothly and members are to obtain the greatest amount of enjoyment from them.



Members of the Harold Wood Branch, No. 109, at work at "Liverpool Street," the main terminus of the Branch's non-continuous layout, on which there are four other stations. Each member of this Branch in turn acts as General Manager. Chairman, Mr. B. G. Underwood ; Secretary, C. L. Barber.

Accommodating New Members

The programme will call for serious thought. At this time of the year enthusiasm is high and new members probably will be recruited in large numbers. In Branches that are well established it is no easy matter to arrange a programme that will satisfy both veterans and newcomers. How the requirements of both are to be dealt with is a problem that is now being considered in many Branches, and various solutions have been discovered. For instance, in one highly successful Branch new members are absorbed by the simple process of appointing them to junior positions on the staff. This Branch is organised on lines that I have previously recommended. The members form the staffs of various departments, these being arranged almost exactly as on real railways. One section takes care of the track ; another is responsible for the preparation and running of locomotives ; a third controls signalling arrangements ; and so on, each department being under the charge of a responsible official. The newcomers are allotted to the various sections and commence work at the bottom with the prospect of earning promotion by care and strict attention to duty.

In several other Branches it has been found advisable to divide the members into senior and junior sections, the two carrying out operations separately. It is not necessary that they should possess separate tracks, for a layout suitable for work of all kinds may easily be designed. In yet another Branch the excellent plan has been followed of forming what may be described as a railway school, newcomers to the Branch being organised in a special section under the charge of one of the older members.

By the adoption of one of these methods, or by other means that may appear more suitable for its particular needs, a Branch should have no difficulty in arranging that simple operations only should be carried out by newcomers, and that the more experienced and ambitious members may have opportunities of carrying on work of a more complex and advanced character.

Usefulness of Railway Visits

I am glad to find that excellent results have followed from the visits to places of railway interest that have been made during the summer by members of practically all Branches. The primary object of such visits to well-known stations, goods yards, or locomotive sheds is to obtain as much information as possible about conditions under which real railway work is carried on, but officials should always bear in mind the possibility of interesting railwaymen in the work of the Branch. The willingness of many of these does not stop at showing members round a locomotive shed, or explaining points of special interest. With a little encouragement, they would be delighted to visit the Branch room and either to talk on their railway experiences, or to make suggestions for the improvement of the layout and for introducing more realistic methods of operation.

Branch Notes

WOODROUGH'S SCHOOL.—Three visits have been paid to Snow Hill Station and notes taken of all interesting items. Members particularly remarked the simplicity of the controls in the driving cabs of locomotives of the "George V" type. A visit is to be made to the Snow Hill Engine Sheds to inspect a "King" class locomotive. Secretary: R. S. Smith, 72, Alcester Road, Moseley, Birmingham.

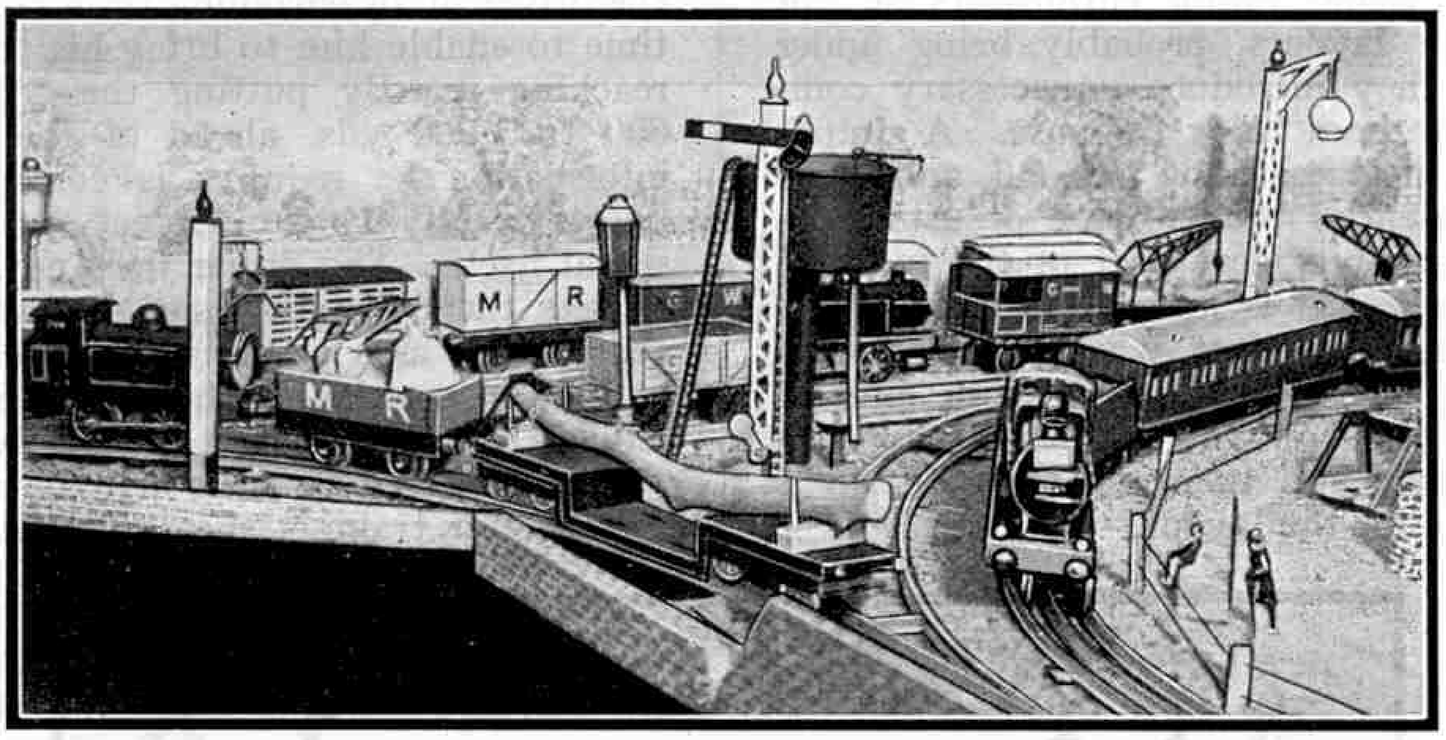
WOODFORD.—A successful Garden Fête was held during the month, by means of which the amount of 13/- was added to Branch funds. It has been necessary to move out of the "Engine House"—the Branch meeting room—owing to the fact that this is to be demolished. New quarters have been found and a track laid down on wooden benches erected for the purpose. Secretary: J. H. Skelt, "Walberswick," Woodside Road, Woodford Wells, Essex.

SAINT NICHOLAS (BIRMINGHAM).—At a recent track meeting a garden layout was utilised for branch line working. New Street Station (L.M.S.) was visited by the members, who were allowed to go on the footplates of several engines. A visit is to be paid to inspect the working of the 0–10–0 banking engine on the Lickey Incline. A discussion is to be held shortly on "*The Needs of the Branch*," and it is hoped that this will lead to greater efficiency in general working. Secretary: John E. Wilson, 23, Meadow Hill Road, King's Norton, Birmingham.

KENSINGTON.—A signal box has been erected and fitted with switches to control the colour light signals. The batteries operating these are situated under the floor of the cabin. A plan of the layout has been drawn up on which the signals are marked and numbered. This has been placed in the signal cabin, and the control switches are also numbered so that the operator recognises at a glance the switch that controls each signal. The members of the Branch now possess a fleet of model yachts and some fine games, in which rum runners and Government boats play large parts, have taken place on the Round Pond in Kensington Gardens. Secretary: D. J. Higgens, 28, Hillersdon Avenue, Barnes, S.W.13.

SOUTH BIRMINGHAM.—This Branch has been divided into two sections, the members of one of these giving special attention to railway photography. The Hornby Control System has been fitted to the Branch layout. This has added greatly to the realism of operations. Members have been organised in sections to represent the staffs of two railway companies and there is keen rivalry between them, each section making strenuous efforts to maintain the best record in timetable working. For the summer, cycle runs have been arranged. A party of members has visited the L.M.S. works at Derby, and other interesting outings have been arranged. Secretary: E. Sharp, 156, All Saints Road, King's Heath, Birmingham.

CHINGFORD.—Owing to the large amount of rolling stock and locomotives possessed by this Branch the layout became rather congested. The timetable was therefore overhauled, and the new arrangements made at once improved the situation. A Lantern Lecture on "*London's Underground*" was given and greatly appreciated. An interesting debate was held on "*Electricity v. Steam*" as a source of power, this resulting in a victory for those who championed Electricity. During recent locomotive trials some excellent results were obtained. An "M." locomotive hauled its tender and three coaches over nearly 70 ft. of difficult garden track, and the No. 2 and No. 1 Special locomotives of the Branch easily surmounted a gradient of 1 in 6 on a track 8 ft. in length.



The goods yard on the layout operated by members of the South Birmingham Branch, No. 121: Chairman, Mr. E. Sharp. Secretary, Eric Sharp. Rounding a bend on the main line is a Hornby Midland Compound, and a Hornby No. 1 Tank Locomotive is dealing with loaded wagons. Effective use is made of a wall-paper frieze that serves as a background.

Secretary: D. G. Tucker, 31, Frederica Road, Chingford, E.4.

NOTTING HILL.—A raised track is being installed and the two rail motor cars made by the Branch Manager are to be put into service for suburban work. Several interesting visits have been paid to Victoria and Paddington Stations. and the information gained from these visits is to be used in planning track operations. Secretary: Mrs. Helen A. Sharp, 110, Cornwall Road, Notting Hill, W.11.

KATHLABERKE.—Visits have been paid by the Branch members to the Stroud Station, Clifton Zoological Gardens and to Bristol to see the British and French cruisers lying in harbour. A new track has been designed. This incorporates three branch lines in addition to the main line. Cricket features prominently on the Branch programme and some excellent matches have been played. Secretary: R. Bennett, Church Street, Wotton-under-Edge.

OVERSEAS

ALEXANDRIA.—During the summer holidays it is hoped to hold as many as four meetings a week, one of which it is intended to devote to sport. Timetable working has been started and has been so successful that it is becoming a regular feature of Branch work. A Branch Library has been started and each member has subscribed to it. A Riviera "Blue" Train has been added to the Branch stock and the Hornby Control System is being introduced for use on the Branch layout. Secretary: W. D. Draycott, 44, Rue Tigran Pasha, Sporting Club, Alexandria, Egypt.

Further Branches in Course of Formation

The following new Branches of the Hornby Railway Company are at present in process of formation and any boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters, whose names and addresses are given here. All owners of Hornby trains or accessories are eligible for membership, and the various secretaries will be pleased to extend a warm welcome to all who send in their applications:—

BARNSLEY—George Hunt, 69, Highstone, Worsbro' Common, Barnsley, Yorks.

BELFAST—N. Gregg, 8, Wheatfield Gardens, Belfast.

CASTLE HEDINGHAM—E. R. Tobitt, Argyll House, Castle Hedingham, Essex.

COLWYN BAY—Robert E. Jones, "Granville," Woodland Road, Colwyn Bay.

DUNFERMLINE—W. McArthur, 20, Headwell Road, Dunfermline.

EPSOM—C. B. White, "Ranworth," Kingsdown Road, Epsom, Surrey.

FARNBOROUGH—R. Fairbairn, "Woodthorpe," Tribbenden Lane, Farnborough, Kent.

GUERNSEY, C.I.—D. Creasey, Doyle Lodge, Brock Road, Guernsey, C.I.

ILKESTON—Frank Caddick, "Woodthorpe," Catherine Avenue, Ilkeston.

LONDON, N.W.1—S. Meywood, 43, Kentish Town Road, Camden Town, London.

LONDON, E.7—W. G. Whiting, 153, Ramsay Road, Forest Gate, London, E.7.

MARGATE—K. Chescoe, 47, Windsor Ave., Margate.

ROCK FERRY—W. J. Davies, 17, Beech Road, Woodhey, Rock Ferry, Cheshire.

SMETHWICK—C. Goodwin, 100, Church Lane, Smethwick.

ST. NEOTS—D. F. Cheesman, The Bungalow, Eaton Socon, St. Neots, Beds.

OVERSEAS

AUSTRALIA—Kevin Cameron, "Lavelle," Millmerran, via Toowoomba, Queensland.

AUSTRALIA—H. N. Johns, 11, Seale Street, Leichhardt, Sydney, N.S.W.

AUSTRALIA—Mr. G. Otzen, 2, North Street, Castlemaine, Victoria.

FRANCE—N. Franco, 3, Square du Trocadero, Paris XIV.

Further H.R.C. Incorporated Branches

132. BLACKROCK—Ian H. Houston, Bank House, Blackrock, Co. Dublin.
133. BORDESLEY GREEN (BIRMINGHAM)—Mr. W. J. Praed, 104, Whitacre Road, Bordesley Green, Birmingham.
134. PORTSMOUTH (NORTH END)—Thos. E. Wright, 27A, London Road, North End, Portsmouth.
135. CHURCHILL (OXFORD)—R. Blake, The Forge, Churchill, Oxford.
136. HADFIELD (SPRING BANK)—Arthur Aldous, 1, Marlow Street, Hadfield, Manchester.

MEMBERS OF THE H.R.C. ARE ENTITLED TO WEAR THIS BADGE WHICH IS BEAUTIFULLY ENAMELLED IN COLOURS

Hornby Railway Company

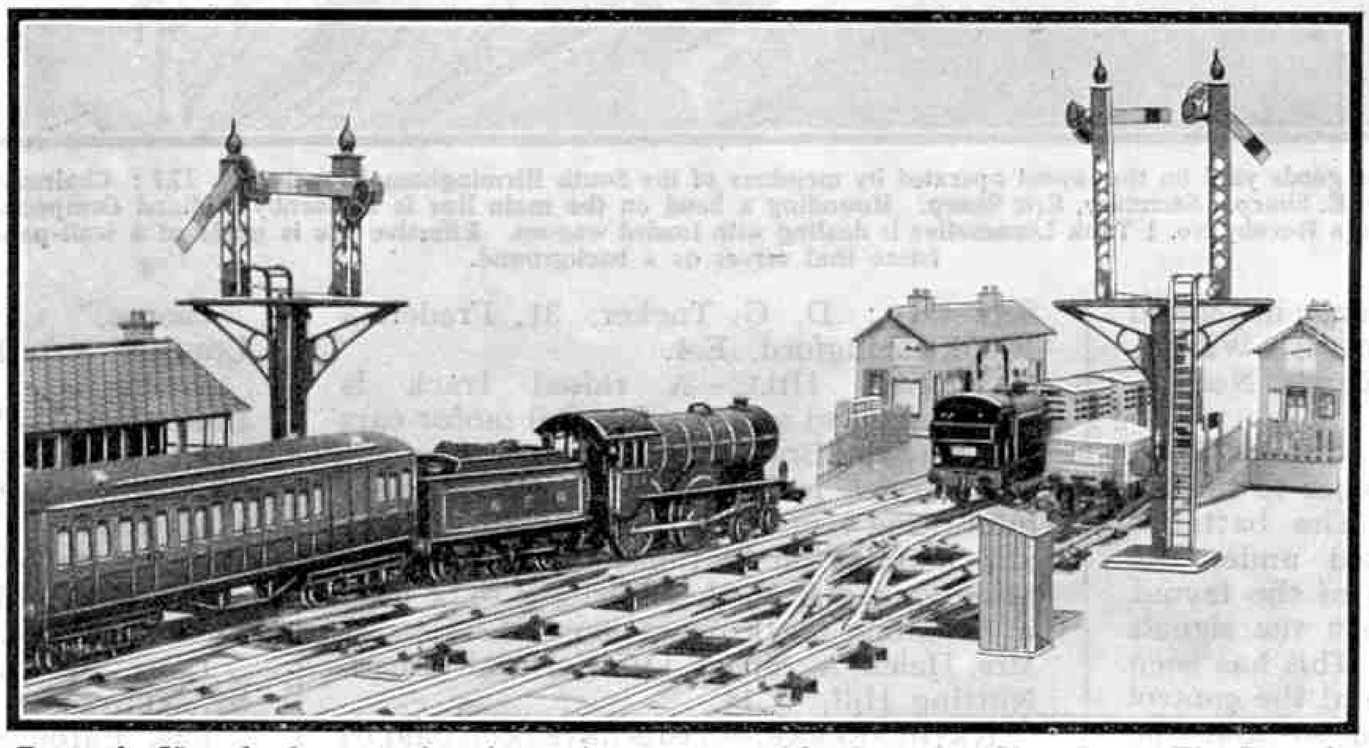
JUNIOR SECTION

XXI.—How to Use Signals

MEMBERS OF THE H.R.C. ARE ENTITLED TO WEAR THIS BADGE WHICH IS BEAUTIFULLY ENAMELLED IN COLOURS

THERE is no branch of miniature railway work that gives so much satisfaction as does the correct use of signals. Some Junior enthusiasts do not include these in their layouts, probably being under the impression that they introduce unnecessary complications. This is far from being the case. A simplified signalling system may easily be planned, and those who have once experienced the pleasure of using one will know that without it a large part of the fun and realism would disappear. It is not necessary to make elaborate preparations, and in fact, it is quite as bad to overdo the signalling of a small layout as to omit it altogether. The best plan to follow is to think carefully over the uses of signals and then try to build up a system that is suitable for the layout.

The purpose of a signal is either to stop a train from proceeding further or to give it the right of way. In this country the most usual type is the drop semaphore, the arm of which remains horizontal when a train is to be stopped and is allowed to fall into a sloping position when all is clear. The signals in the Hornby Series are of this type, and one of them should be used in all positions on a layout where it may be necessary to stop or restart a train. These include stations and also positions near points.



Part of a Hornby layout, showing points protected by Junction Signals. The Hornby No. 2 Special locomotive, "*Yorkshire*," is bringing its train off a loop or relief line on to the main track. The positions of the signal arms on the right show that the goods train is to cross over to the loop line on its left.

In practice it has been found that the use of one signal only is impossible, and complicated systems have been devised in order to make working easier, safer and more rapid. In fact, signalling may be described as a distinct branch of railway engineering, and it is an extremely important one, for the safety of passengers largely depends on the correct working of the system adopted.

On a miniature layout it is quite impossible to reproduce all the complexities of the signalling systems used on real railways, but it is not difficult to introduce the more important features. For instance, the "distant" signal may be made use of. This is a warning signal that readily may be distinguished from the type already referred to by the shape of its end. It is fish-tailed, while the "home" signal, as the one already mentioned is called, has a square end. The chief purpose of the "distant" signal is to act as a repeater of the "home" signal. When the latter is at danger the driver of an oncoming train requires notice in ample time to enable him to bring his train to a standstill on reaching it. By putting the "distant" signal from 600 to 1,000 yds. ahead of the "home" signal the information he requires is conveyed to him and he knows exactly what to expect on reaching the "home" signal itself. The driver does not pull up immediately he sees the "distant" signal against him. He simply accepts this as a warning that the "home" signal also may be in position to check his further progress and he reduces speed in order to be ready for this emergency.

It will be seen that the first signal encountered by the driver of a train is the "distant" signal, this being followed by the "home" signal. In most stations there is a third—the starting signal. Sometimes a train comes to a standstill in a position a little beyond the "home" signal, and it is the purpose of the starting signal to give it the right of way from a position of this kind.

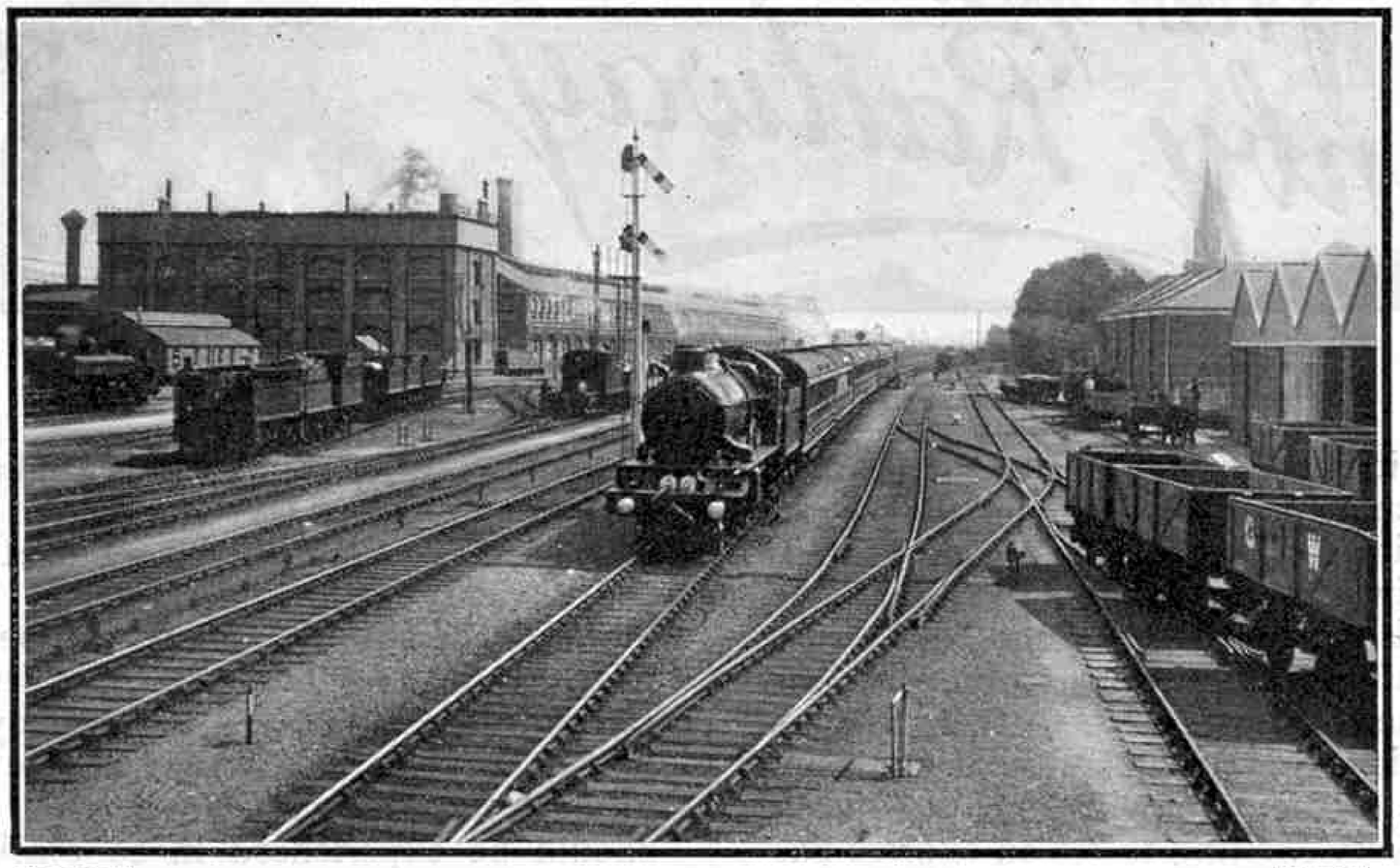
All three classes of signals may be employed on a miniature railway, but if this is done the layout often appears to be overcrowded. "Home" signals are necessary, of course, and if at all possible "distant" signals also should be included, Hornby products of correct design being available for both positions.

No difficulty will be experienced in finding a good position for a "home" signal, but at times the use of a "distant" signal introduces complications. We have already pointed out that in real practice this is placed about half a mile ahead of the "home" signal, and unfortunately on a miniature railway it is usually impossible to follow this scale in finding a position for a "distant" signal. It is therefore necessary to bring it nearer the "home" signal, and if a convenient place cannot be found it may be omitted.

Settling the actual positions in which the signals should be employed calls for care and thought, if the appearance of a layout is to be at once realistic and attractive. A good rule to follow is to ensure that all points are adequately protected by means of signals,

and the stations also should be provided with the usual quota, a "home" signal being provided in addition to the starting signal beyond the end of the platform that informs the driver of a train when he may pull out.

One mistake that is often made by Junior enthusiasts is to place signals too close to the points they protect. This is bad practice. A short distance should always be left between the foot of the signal posts and the points themselves. If this is not done there is a possibility that a train may unwittingly be driven too close to the latter, with the result that they become fouled and cannot be moved when they should be changed in order to allow the train to proceed further.



Courtesy] [*G.W.R.*

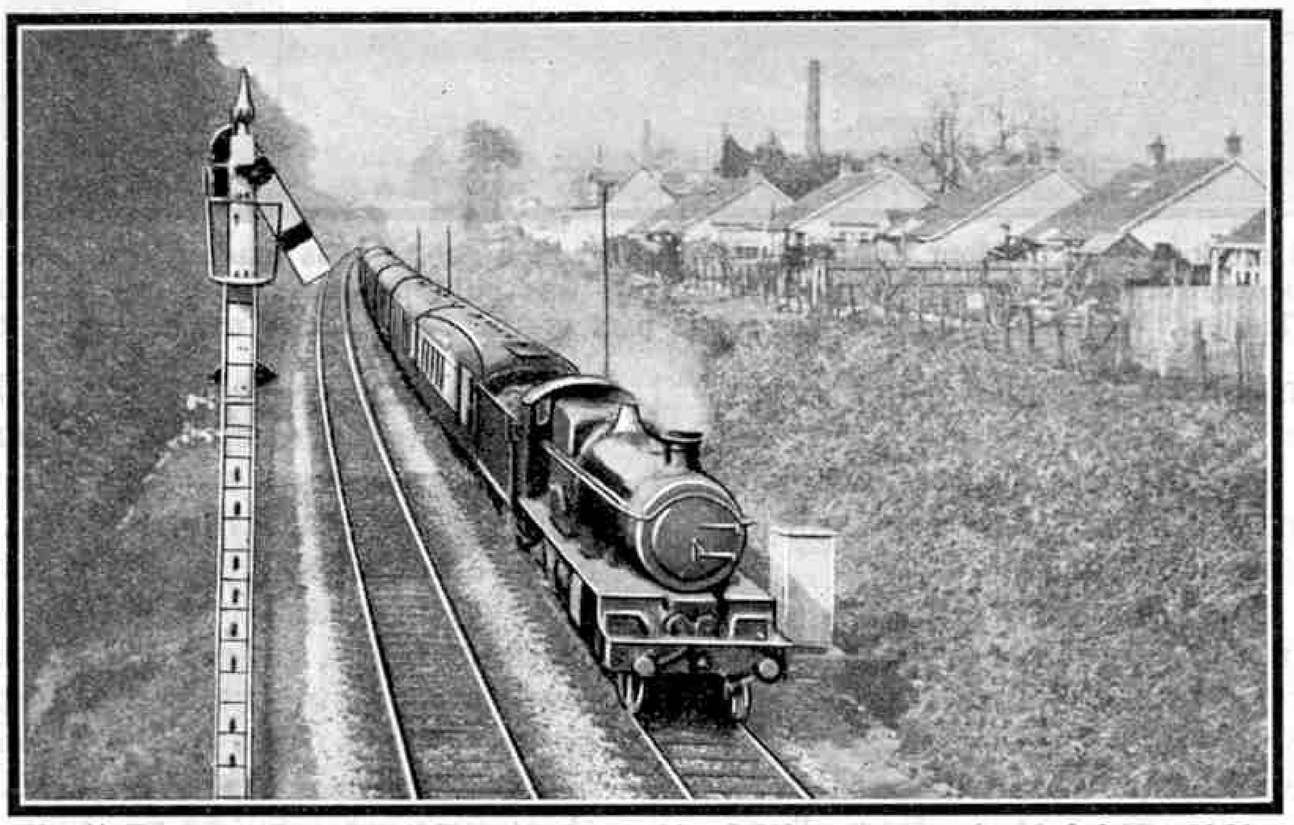
A G.W.R. London-Bristol Express, hauled by a "Castle" 4-6-0 locomotive, passing Swindon Works. The signal post is in the "six-foot way," a position peculiar to certain sections of this railway.

In providing signals for points the Hornby Junction Signals should be employed, for these clearly indicate which of two routes is open. They have arms mounted on short posts erected side by side at the top of a longer one. Each of the signals applies to the road on its own side. In real practice the further distinction is sometimes made that the one controlling the main line is taller than the one giving entry to a siding or access to a branch line. This plan is followed in the construction of Hornby Junction Signals, but by the exercise of a little mechanical ingenuity they may be adapted for use in positions where it is undesirable to emphasize the difference.

It is very important that signals should be placed where they may be seen clearly and at the earliest possible moment by the drivers of approaching trains. The necessity for this is the explanation for the extremely tall posts that are sometimes seen on the main lines of our railways. By means of these the arms are made to show up well against the sky and the driver is thus able to see them quite easily when travelling at high speed. A tall signal is often provided with two arms that work together, one being placed at a point only a comparatively short way up the post. This arrangement is made for the convenience of the drivers of trains that may be stopped at one of these signals, for they would find it awkward to keep in view an arm so far above them and in foggy weather this may be quite invisible.

If it is impossible to place the arm of a signal in a good position, and a dark background is unavoidable, a white-painted sighting screen is mounted on the post behind the arm, which shows up clearly against it. Similar screens may readily be fitted to Hornby signals. Cardboard is the best material to use for their construction. If necessary, this should be painted white and fixed at the back of the signal post, a slot being cut in the card to accommodate the signal ladder. This slot should be only just large enough to allow the ladder to pass through it. The screen may be further secured by means of fine wire or cotton. If it is attached in this manner it may readily be removed without causing any damage to the signal. It will be necessary to cut a hole in the screen through which the spindle of the semaphore may pass. This should be so large that the movement of the spindle is not impeded.

The usual place for a signal is on the left of the track to which it applies. But even this rule may be broken in order to secure early visibility. For instance, on a sharp curve to the left a signal may be placed on the right of the track. Another exception to the general rule is frequently seen on the Great Western Railway, and this introduces a feature of that line that may be imitated by those whose layouts represent a section of it. Originally the track of the G.W.R. was of broad gauge, the distance between the rails being 7 ft. instead of the standard 4 ft. $8\frac{1}{2}$ in. When the change to narrow gauge was carried out, the operation was effected by moving the inner rails toward those next the platforms. Thus the space between the tracks was largely increased and where convenient, signals are now placed in it. This is helpful to drivers of G.W.R. locomotives, whose position is on the right-hand side of the footplate, and often enables a clear view of a signal to be given on a curve.



The "*Torquay Pullman*" Express hauled by G.W.R. locomotive 4-6-0 No. 4063 "*Bath Abbey*." The tall signal is placed on the right-hand side of the line and mounted on the post is a diamond-shaped plate showing that this portion of the line is track-circuited. For this photograph we are indebted to our reader, B. J. Holden, Horley, Surrey.

XXIII.—HOW TO MAKE AND USE TUNNELS

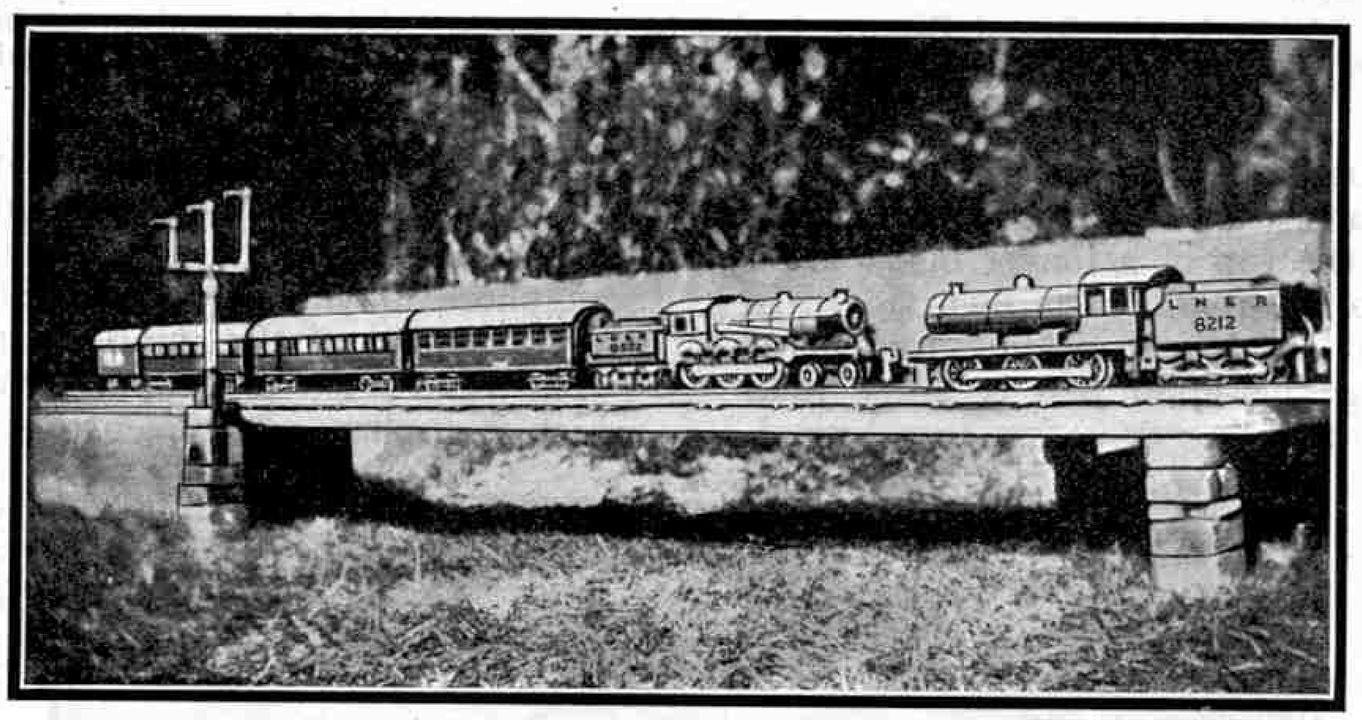
OWING to inequalities of ground and to the need for crossing rivers and roads, bridges and tunnels are a vital necessity on real railways. Naturally owners of Hornby Railways wish to reproduce characteristic structures of this kind, for these not only enable them to follow real railway practice in track operations, but also give a distinctive appearance to their layouts. Apart from their scenic attractions, the use of miniature tunnels and bridges introduce thrills into miniature railway work. It is very exciting to see an express passenger train plunge into the depths of an underground section of the line, and it is even more so to see it emerge at full speed from the other end.

A difficulty that arises immediately a tunnel or bridge is considered is that of scale. This is particularly the case when efforts are made to reproduce well-known engineering features. An excellent example would be given by efforts to include a replica of the Forth Bridge. The bridge itself is nearly two miles in length, if the approach spans are included, and to include a reproduction to scale on an ordinary model railway layout is almost impossible on account of lack of space.

Similar considerations apply to tunnels. On most British railways there are many tunnels of great length in which trains are completely engulfed for long periods. To build a miniature railway track that burrows underground for proportionate lengths would take away a good deal of the fun of operations, for after all enthusiasts do like to see their trains!

Another objection to the use of long tunnels is the difficulty of extricating locomotives and rolling stock in the event of a derailment or a stop for any other reason. It may be argued that on a well-planned track derailments will not occur, and that there is no reason why a train should stop in a tunnel if intelligent attention is given to the task of winding up the motor. But accidents will happen. Partly for this reason, and partly for those already given, in miniature railway work it is not advisable to build a tunnel long enough to enclose an entire train. This applies particularly to the case of an outdoor layout, where a tunnel is constructed through a rockery, or in some other manner is made to form part of the landscape.

When the site of a tunnel has been decided upon, the next step is to fix its position. There are many places on model railways where a tunnel may be made to serve a useful purpose, and where at the same time it has a natural appearance. Very little difficulty, therefore, should be experienced in so placing it that it blends with the rest of the scenic accessories employed and does not reveal itself as an artificial tunnel used only to give its owner the pleasure of seeing trains dash through it.



A section of an outdoor miniature track on which good use is made of cardboard locomotives and rolling stock. The layout was built by our reader, Mr. M. B. Flanders, Walthamstow, and represents part of the G.E. section of the L.N.E.R.

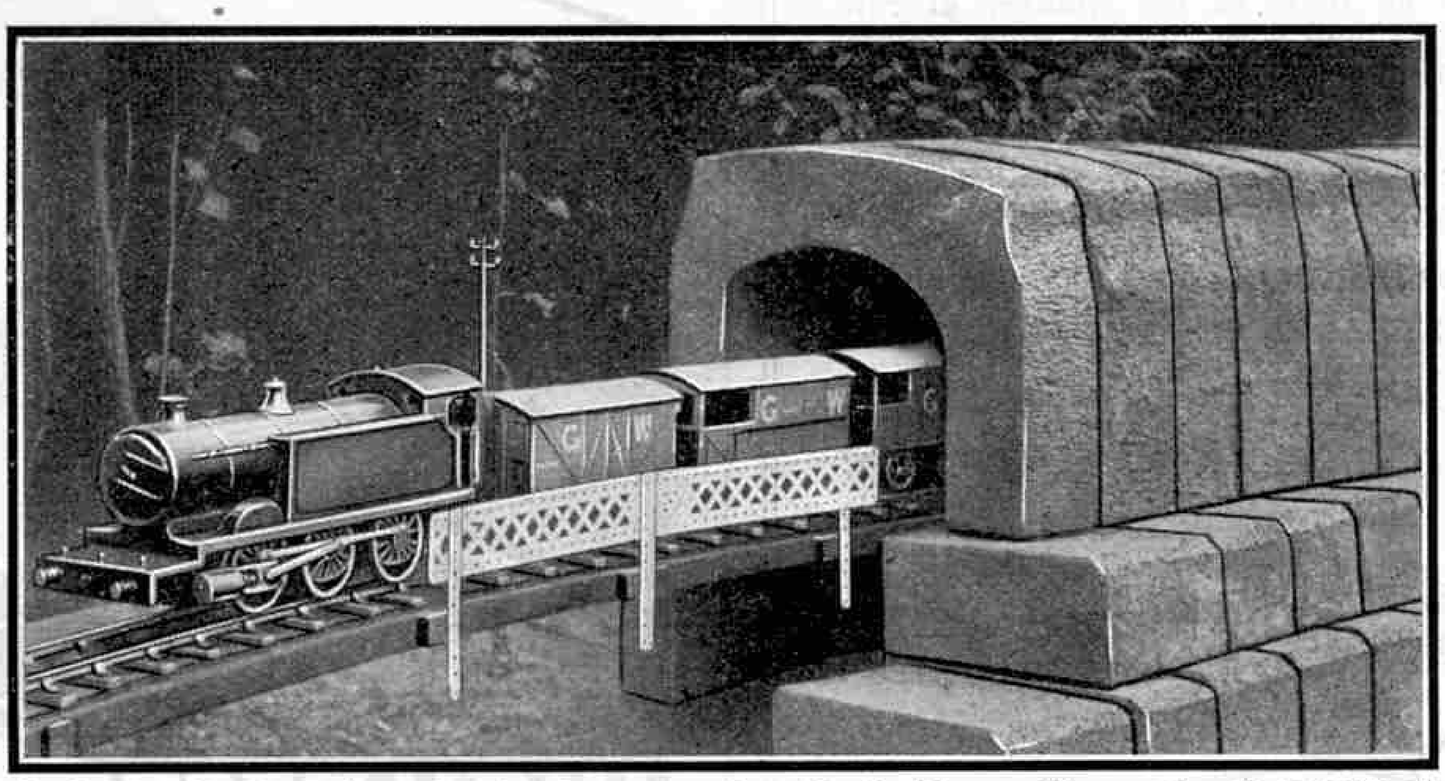
An excellent place in which to erect a tunnel is in such a position that it masks awkward features of the room or space allotted to the layout. Fireplaces and other fixtures cannot be said to be suitable adjuncts for a railway, but with the exercise of a little ingenuity it usually is possible to disguise or hide them by this means.

When planning an indoor layout a corner of a room often presents a little difficulty. Often this may readily be overcome by the introduction into it of a tunnel. This plan is particularly suitable when a scenic frieze is employed, for, unless special provision of some kind is made, the two sections of background that meet at a corner are at right angles to each other and often give a curious effect that completely spoils the realism that they were intended to produce. All trouble of this kind may be avoided by constructing a miniature hill in the corner and driving a tunnel through it. This course also has the advantage that the sudden change in the direction of the track is disguised.

A very effective use of a tunnel may be made on layouts similar to that described in Captain Rodger's article on page 542 of the "*M.M.*" for July, 1930. It will be recalled that the main line of this layout—which represents the Eastern and Central Sections of the Southern Railway—passes completely round the layout. Stations are provided at intervals. Many of these are on

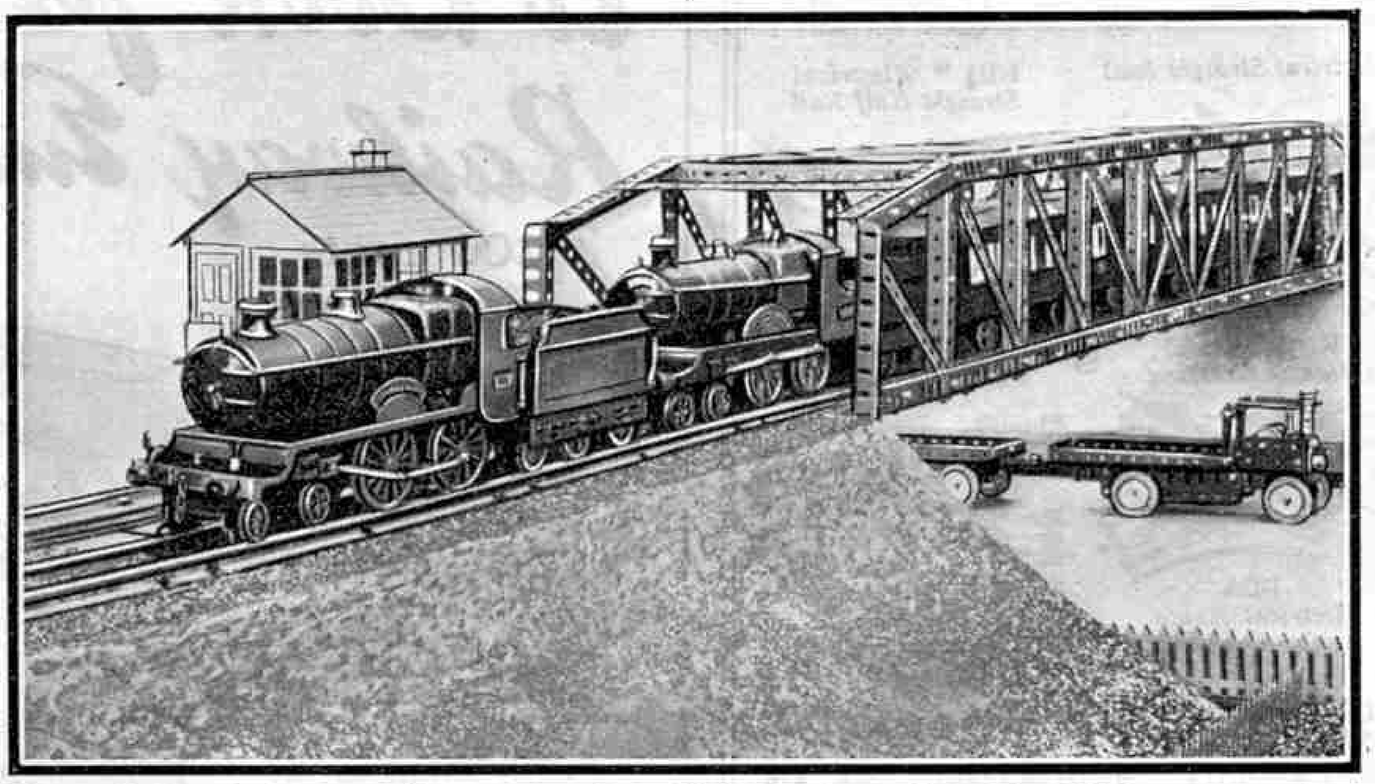
loop lines, and access to them from the main line is given by means of crossovers. This is an excellent scheme for the representation of a long stretch of main line in the space afforded by an ordinary room. But unless such a track is well planned, it may have the disadvantage that miniature passengers may suddenly be surprised to see alongside the track over which their train is passing a station that they left some time previously! It certainly is not realistic to see main line tracks passing near what is undoubtedly a terminal station.

Fortunately this effect may be avoided by intelligent use of tunnels. One side of the tunnel faces the terminus or other station that is to be effectively separated from the main line. This may take the form either of a retaining wall or a cutting through rock. In most cases in which layouts of this kind have been constructed the stations are near the front and the main line passes between them and the walls of the room. This makes it comparatively easy to arrange scenery on the top of the tunnel in order to give the effect of a countryside scene. The appearance of this may be greatly improved by the use of a suitable frieze in the background. When used in this manner a tunnel adds greatly to the attractiveness of a layout in addition to making it more in accordance with real railway practice.



An interesting tunnel constructed by our reader, Mr. G. Hemm, Liverpool. It is built of specially prepared bricks and may be made of any desired length by the addition of new sections.

Unless it be made to represent a rock cutting the side of the tunnel that faces the station will need some attention. A bare wall would detract from the attractive appearance of the scene and it is an excellent plan to paste on it advertisements of suitable size, which may be cut from magazines. An alternative to both plans is to place in front of the wall of the tunnel representations of buildings, including shops, houses and churches, of a type that may be seen from many railway stations. Of course, this plan should not be adopted when a tunnel is employed in this manner to cut off the main line from a wayside station.



A realistic miniature railway scene in which good use is made of Meccano parts. A Hornby Pullman Express, hauled by two G.W.R. "County" locomotives, crossing a Girder Bridge that carries the track over a main road.

The next step is to decide on the means to be adopted in building up a tunnel. A ready-made tunnel, such as the excellent accessory in the Hornby Series, may be used with advantage, but often it becomes desirable to include a longer one. No difficulty will be experienced in building a tunnel of any length, for shortly Hornby Tunnel Ends will be available. These are now to be made separately from the tunnels themselves and will be sold at 2/9 per pair. They are of realistic design and may be used as entrances of a tunnel in practically any suitable position.

In addition to the Ends a covering of some kind will be necessary for the tunnel. This may easily be constructed by bolting Meccano girders to Hornby Tunnel Ends, and over these cardboard or stout brown paper may be placed. On this as a foundation, crumpled paper or cardboard may be glued in order to give an uneven surface, and the whole may then be covered with a green cloth or with paper painted in suitable colours. Those who wish to give their tunnels an even more realistic appearance may cover them with sand and imitation moss, these being fixed in position by giving the outer surfaces of the tunnel covering a thin coating of glue.

Another material that may be used as a tunnel covering is papier-mache. This may be made at home, the simplest way being to boil pieces of old newspapers in water until they become soft and pulpy. The water should then be strained off and a little glue or size added to enable the material to set hard when being laid in position. It may be shaped as desired, and should be allowed about three weeks in which to dry. One advantage it possesses is that water paint may be added to it when pulpy, thus enabling material of any colour wished for to be made.

A very interesting system of tunnel construction that has been adopted by a reader of the "*M.M.*" is shown on the upper illustration on this page. The tunnel itself is built up from a number of specially prepared bricks. These are moulded from a mixture of cement and sand to which shaly material has been added, and then burnt in a small kiln. The handiness of bricks of this kind will be apparent. Not only may tunnels of any length be constructed, but it is a very easy matter indeed to take down and rebuild these structures when it is desired to remodel the layout.

On an indoor layout there is not perhaps the same scope for bridge building as for (*Continued on page 752*)

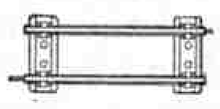
Rails, Points and Crossings

Gauge 0, 1¼". Hornby Series. Alternate Pegs.

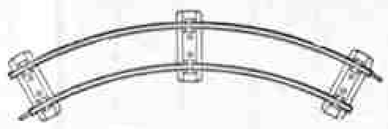
Hornby Rails, Points and Crossings are built for hard wear and for smooth running. They are made of the finest materials and hold together rigidly and strongly, for real workmanship is put into them. Note the great superiority both in quality and appearance of the Hornby rails, etc., a few of which are illustrated below.

There is practically no limit to the number of rail formations that may be built with Hornby Rails, Points and Crossings. A number of very interesting layouts is illustrated in a booklet that we have published, entitled "How to Plan your Hornby Railway." The booklet is obtainable from your dealer, price 3d., or from Meccano Ltd., Old Swan, Liverpool, price 4d., post free.

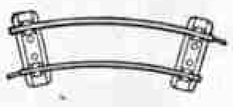
A SELECTION OF RAILS, POINTS AND CROSSINGS FOR CLOCKWORK, STEAM AND ELECTRIC TRAINS



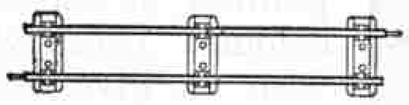
B½ *Straight Half Rail*



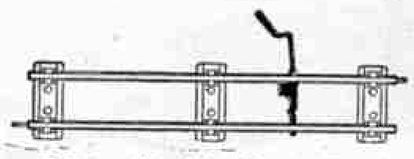
A1 *Curved Rail*



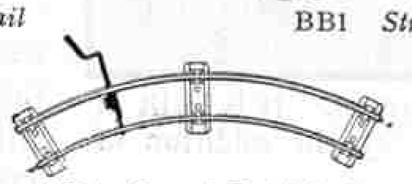
A1½ *Curved Half Rail*



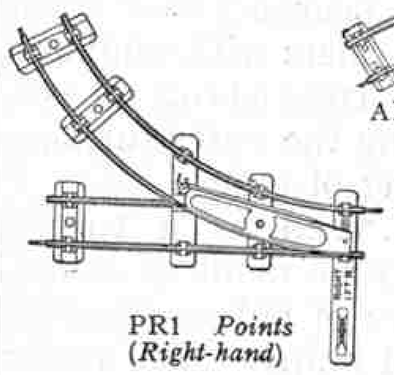
B1 *Straight Rail*



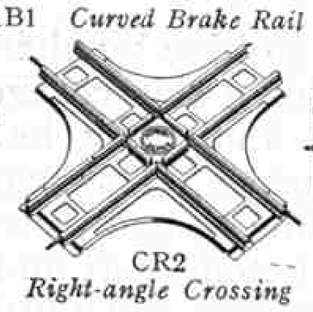
BB1 *Straight Brake Rail*



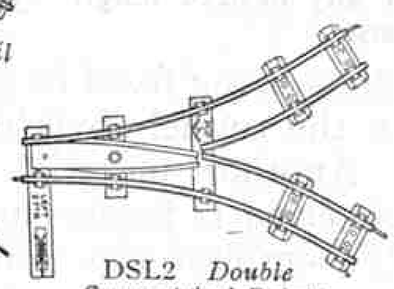
AB1 *Curved Brake Rail*



PR1 *Points (Right-hand)*

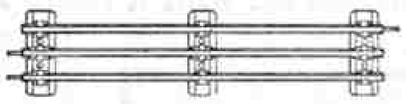


CR2 *Right-angle Crossing*

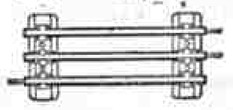


DSL2 *Double Symmetrical Points (Left-hand)*

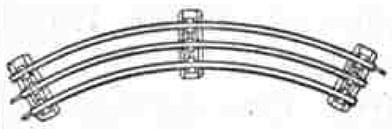
EA1½ *Electrical Curved Half Rail*



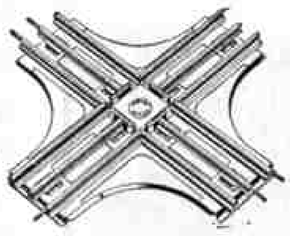
EB1 *Electrical Straight Rail*



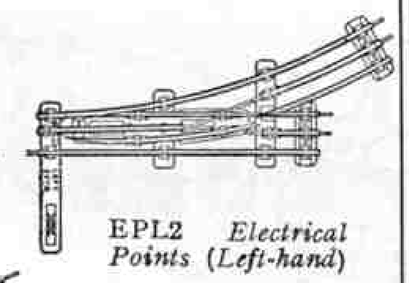
EB½ *Electrical Straight Half Rail*



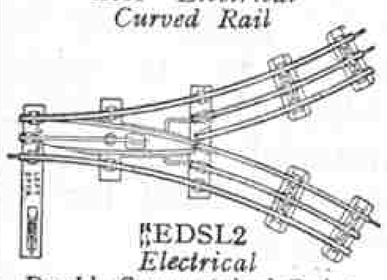
EA1 *Electrical Curved Rail*



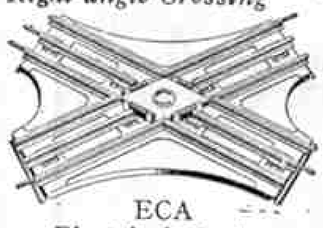
ECR *Electrical Right-angle Crossing*



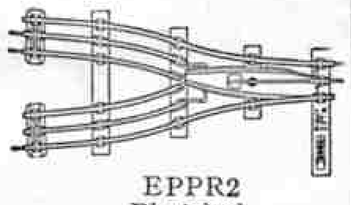
EPL2 *Electrical Points (Left-hand)*



EDSL2 *Electrical Double Symmetrical Points (Left-hand)*



ECA *Electrical Acute Angle Crossing*



EPPR2 *Electrical Parallel Points (Right-hand)*

PRICES OF RAILS, POINTS AND CROSSINGS ILLUSTRATED ABOVE

A1	Curved rails	doz.	4/6	EA1½	Curved half rails ...	doz.	4/6
A1½	Curved half rails ...	,	3/6	EB1	Straight rails ...	„	6/–
AB1	Curved brake rails ...	each	6d.	EB½	Straight half rails	„	4/6
B1	Straight rails	doz.	4/–	EPPR2	Parallel points, right hand	per pair	8/6
B½	Straight half rails ...	„	3/–	EPPL2	Parallel points, left-hand		
BB1	Straight brake rails...	each	5d.	EPR2	Right-hand points	per pair	7/6
PR1	Right-hand points	per pair	4/–	EPL2	Left-hand points		
PL1	Left-hand points			EDSR2	Double symmetrical points, right-hand	per pair	8/6
DSR2	Double symmetrical points, right-hand	per pair	5/–	EDSL2	Double symmetrical points, left-hand		
DSL2	Double symmetrical points, left-hand			ECA	Acute-angle crossings	each	4/–
CR2	Right-angle crossings	each	1/9	ECR	Right-angle crossings	„	4/–
EA1	Curved rails	doz.	6/6				

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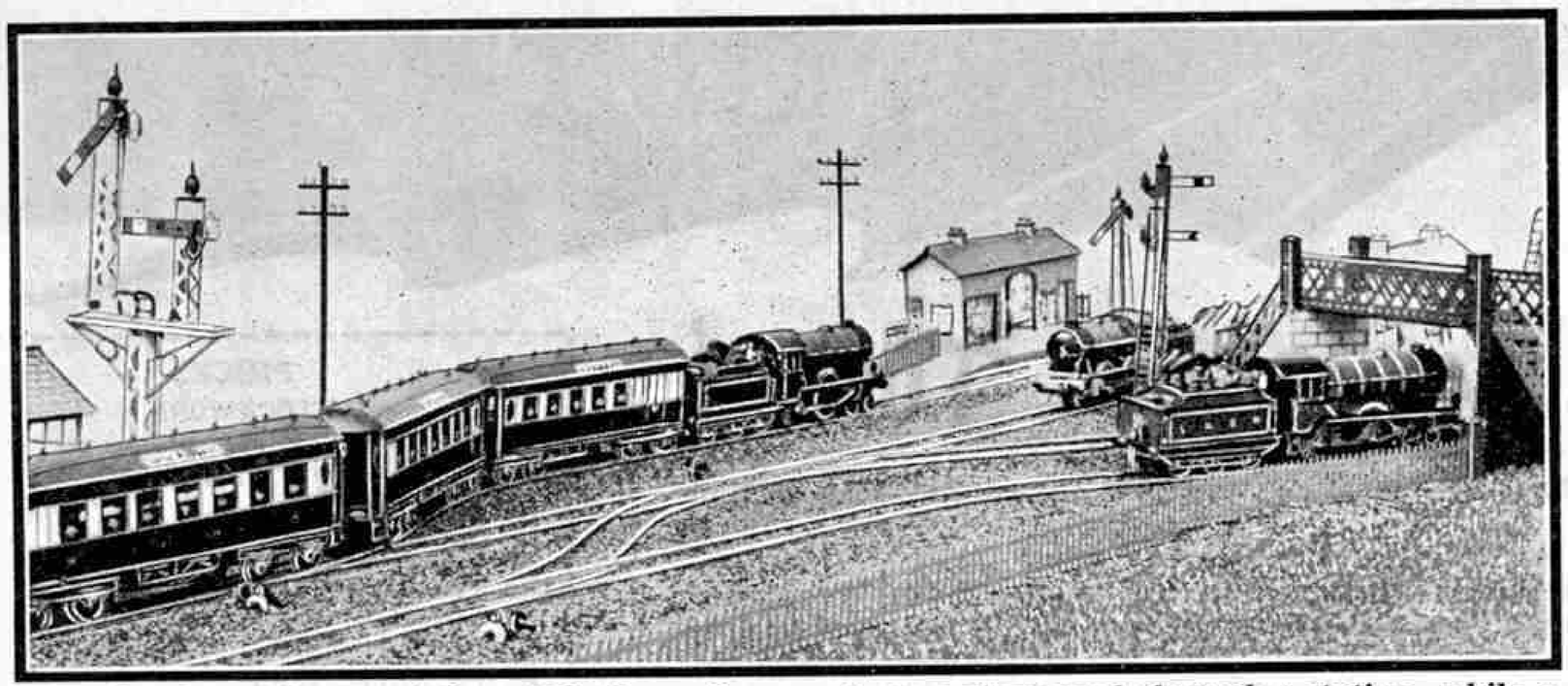
MECCANO LTD. (Dept. AC.), Old Swan, LIVERPOOL

Enamelling Hornby Trains

By "Tommy Dodd"

EVER since their introduction Hornby Trains have been remarkable for their wonderful finish. Locomotives, rolling stock and all accessories are carefully enamelled and painted in correct colours and possess beautifully smooth and glossy surfaces that are capable of much hard wear. After making several tours of the works I am not surprised that the finish given to them should be so effective, for the greatest precautions are taken to ensure that the enamelling and painting are carried out in the most efficient manner. Any idea that appears likely to bring about improvement is thoroughly tested, and every year sees the introduction of better methods of spraying and varnishing.



The Hornby "*Queen of Scots*" Pullman Express given a clear road through a station, while a goods train is held at the double arm signal in order to allow the light engine travelling backwards under the bridge to proceed. On this interesting layout a double junction turnout has been constructed by the use of 1 R.H. and 3 L.H. points.

The enormous amount of care and attention that is given to this branch of the work of producing Hornby Trains was made very clear on one of my recent tours of the factory in which they are made, when I had the privilege of inspecting the latest devices employed. I was particularly interested in the manner in which the parts of locomotives and rolling stock were being enamelled before their final assembly. The coating being given to them was not the glossy one with which the owners of Hornby Trains are familiar—that is given at the last stage of manufacture. Instead it gave them a matt appearance, every portion of the surface of each article being covered with a fine coating of enamel. This is effected by means of a compressed air gun that directs a fine spray of the enamel into every corner and produces an even covering of the correct depth.

An interesting feature of the spraying room is a number of machines on which the spraying is done automatically. On each of these the parts to be covered with enamel are simply placed on holders distributed round the circumference of a large wheel, and as this rotates, each is brought into contact with spray driven on to it by a stream of compressed air. The work proceeds rapidly, and the covering given very soon becomes sufficiently dry to enable the parts to be handled. They are then immediately despatched on their slow journey through the oven and after remaining nearly three hours at a temperature of from 200°F. to 220°F., they emerge on the conveyor with the enamel baked into a hard and durable coating.

As I was watching the parts of Hornby Locomotives undergoing this interesting process my attention was drawn to a tank into which trays carrying a large number of unfinished Hornby Train products were being placed. These had not been enamelled. They had, in fact, come direct from the Press Shop, where they had been stamped out of metal sheets, or from the rooms in which the earlier stages of their assembly had been carried out. When the tank had been filled and the lid clamped down, an attendant carried out mysterious operations with a three-way cock and then stood back.

I took an early opportunity to enquire what was being done in the tank and learned that this was the new de-greasing plant. Naturally parts that have gone through the Press Shop and since then have been handled several times may be slightly oily and greasy. It is of the utmost importance that every particle of dirt of all kinds must be removed before the enamel is sprayed on, for if the surfaces are not absolutely clean in a chemical sense the coating will not be perfectly adherent, nor will a smooth finish be obtainable.

Formerly cleansing was carried out by dipping the parts in chemicals. This involved rinsing and drying and was a lengthy and somewhat cumbersome operation. The new plant ingeniously avoids all trouble of this kind. In it, use is made of a remarkable liquid known as trichlorethylene. A quantity of this is contained in a sump at the bottom of the plant, below which is a steam heating apparatus. As soon as the articles to be degreased are in position, and the plant has been closed, the steam is turned on and the trichlorethylene in the sump vaporised. It fills the tank, circulating round the parts to be cleaned and percolating into the crevices to dissolve out every trace of grease.

Even then the work of the trichlorethylene is not finished, for at the top of the plant the vapour comes in contact with a coil through which cold water is passing. There it is condensed into a liquid. This falls back on the articles on the trays and finally into the sump, carrying with it the grease it has washed away.

After about ten minutes of this the parts in the plant are quite clean and the steam may be turned off. Another turn of the three-way tap causes cold water to pass through a coil at the bottom of the tank, and two minutes later every trace of vapour in the bath has been condensed into liquid and returned to the sump. The cover may then be removed and the parts taken out.

Guarantee

Hornby Trains are tested and their efficiency is guaranteed. A form of guarantee is furnished with each loco.

Hornby Trains are richly enamelled, highly finished in four different colours, and lettered to represent L.M.S., L.N.E.R., S.R. and G.W. locos and rolling stock.

"Royal Scot"

Always on Time!

"That's her signal . . . and here she comes—dead on time as usual!"

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Whether on passenger service, goods traffic, or carrying out shunting operations, Hornby Locos may be depended upon to give the utmost satisfaction. They are British-made throughout, fully guaranteed, and beautifully enamelled in correct railway colours—L.M.S., L.N.E.R., G.W. or S.R. You can't help being thrilled when you see a Hornby Loco dashing along the track, smoothly over the points, steadily round the curves, full speed ahead on the straight.

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HORNBY TRAINS

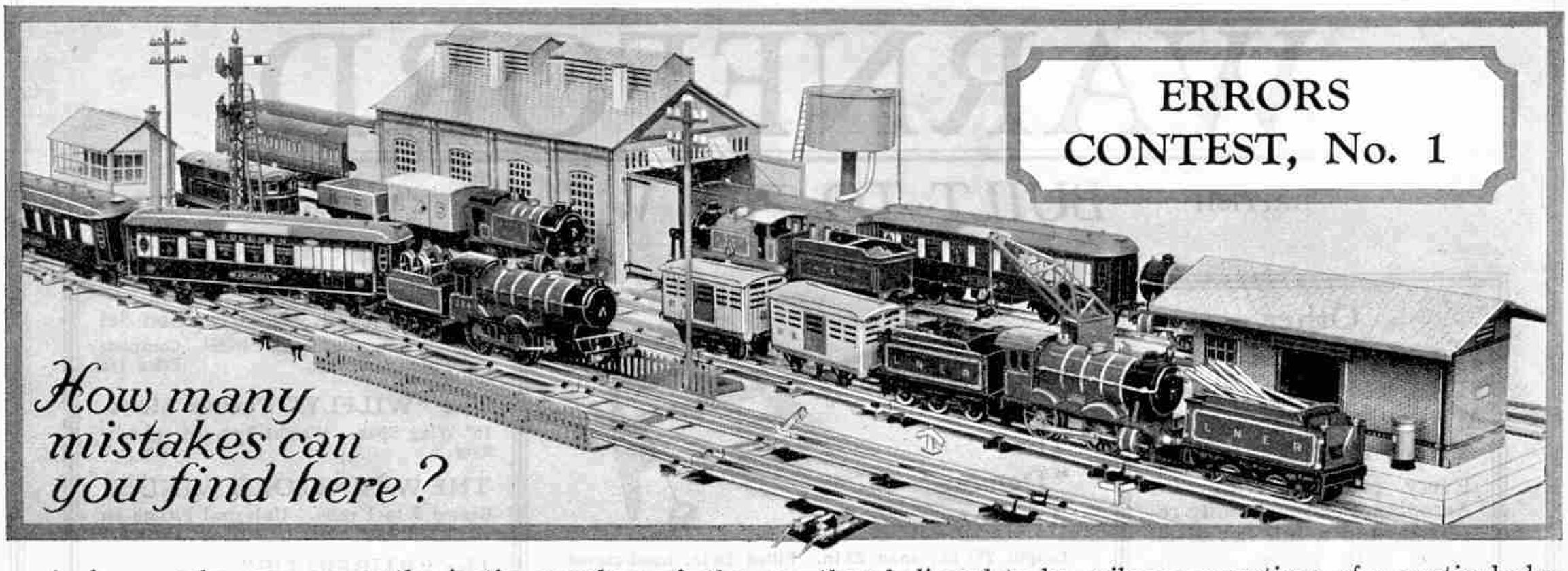
BRITISH AND GUARANTEED

This is the Hornby No. 3C "Royal Scot"—one of the famous trains in the Hornby System.

Manufactured by MECCANO LTD., OLD SWAN, LIVERPOOL

H.R.C. COMPETITION PAGE

Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries, should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Binns Road, Old Swan, Liverpool. The name, address and membership number of each competitor should appear in clear writing on every sheet of paper used.



ERRORS CONTEST, No. 1

A few weeks ago an enthusiastic member of the Hornby Railway Company wrote to tell us of a very amusing experience. He had been away from home for a fortnight, spending a pleasant holiday among the mountains of the Lake District, and on his return he was surprised to find that during his absence his Hornby track had been laid down and one corner of it crowded with locomotives and rolling stock.

"Hello," he said to himself, "I wonder who has done this. They have made quite an impressive show, but I wonder why they put that van without wheels in."

As he bent forward to remove the vehicle, which was waiting to be fitted with new wheels, he noticed something strange about the locomotive and tender near it. He then looked more carefully at the assembly and as he did so he began to laugh, for it was full of mistakes. He examined it carefully, and in the end came to the conclusion that with the material at hand it would have been difficult to make more mistakes. Impossible trains ran over equally impossible tracks; most of the accessories were wrongly placed; and in some cases these appeared in positions where they would have been a perfect nuisance to a serious enthusiast. Our correspondent was so greatly impressed by the amazing scene that he immediately photographed it. A print was forwarded to Headquarters and this is reproduced at the top of the page.

At first glance the photograph appears to be that of an impressive and business like layout. But on closer examination it will be seen that scarcely anything is right, and in fact, the layout may be described as a railway nightmare. Afterwards it was discovered that the owner's younger brother and sister had whiled away a particularly rainy day by carrying out what they believed to be railway operations of a particularly interesting character!

They were certainly interesting, but the two culprits have now decided to join the Hornby Railway Company and any railway working in which they take part in future will be more correct, if not quite so exciting as their first efforts must have been.

After studying the original print we decided that it would give members of the H.R.C. an opportunity of demonstrating their railway knowledge and sharpness, and for our competition this month we ask them to point out as many errors as they can in the layout illustrated. Mistakes are numerous and competitors will be well advised to scrutinise very carefully every portion of the photograph. When each entrant is sure that he has tracked down every error, he should make out a neat copy of his list, and forward this to reach H.R.C. Headquarters, Binns Road, Old Swan, Liverpool, in an envelope plainly marked "Errors Contest, No. 1."

The competition will be divided as usual into two sections "Home" and "Overseas." In each of these the sender of the list that is most nearly correct will be awarded a prize of Hornby Train goods (or Meccano products, if preferred) to the value of 21/–. For the three entries in each section that are next in order of merit, similar prizes of value 15/–, 10/6 and 5/– respectively will be given. A number of consolation prizes also will be awarded, and in the event of a tie neatness and originality in presentation will be taken into account in awarding the prizes.

Each competitor must give his H.R.C. number and entries should be posted to reach Headquarters on or before 30th September. The closing date for Overseas competitors is 31st December, 1930.

A Holiday Contest

During the course of the holidays most H.R.C. members will have travelled considerable distances by rail, or will have had other opportunities of seeing more than usual of railway practice. For our Competition this month, therefore, we ask them to write an account of their railway experiences during their holidays. The prizes in this Contest will not be awarded to the competitors whose entries show that they have the greatest number of journeys in famous express trains to their credit, but simply for the most interesting accounts submitted.

The Competition will be divided into the usual sections—Home and Overseas. In each division prizes of Hornby railway material (or Meccano products if preferred) to the value of 15/–, 10/6, 5/– and 2/6 will be awarded for the four best entries.

Envelopes should be clearly marked "H.R.C. Holiday Competition" and must be despatched to reach Headquarters on or before 30th September, 1930. Closing date, Overseas Section, 31st December, 1930.

1929
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To any **WARNEFORD** enthusiast obtaining a flight of 30 secs. duration with his Warneford Aeroplane a fine pair of Gold Wings and Certificate will be sent **FREE.** The flight must be witnessed and application signed by some responsible person.

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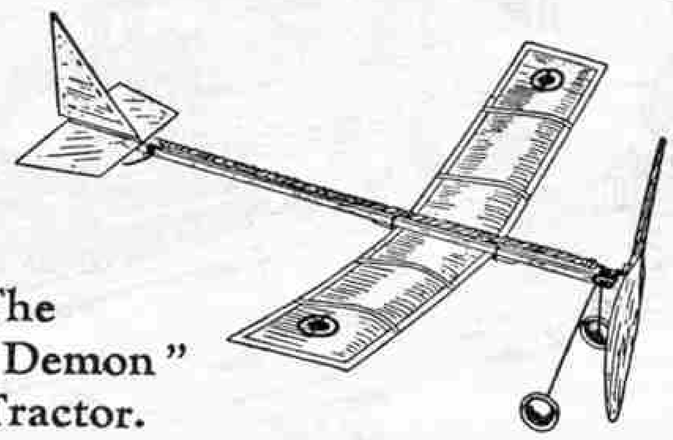

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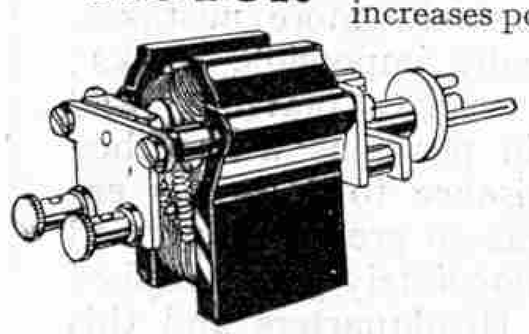

4-volt, fitted with gearing which greatly increases power, and allows Motor to run at great speed under load. Takes only ½ ampere at 4 volts. Silk-covered windings, with laminated turned tripolar armature. Self-starting. Complete with 1½ in. 3-blade Propeller and Shaft. Post 4d. Price **15/-**

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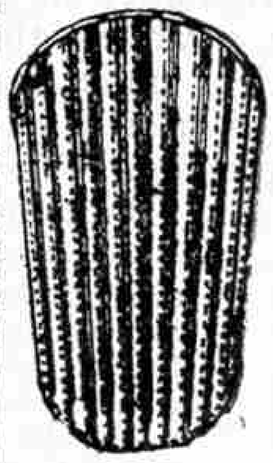

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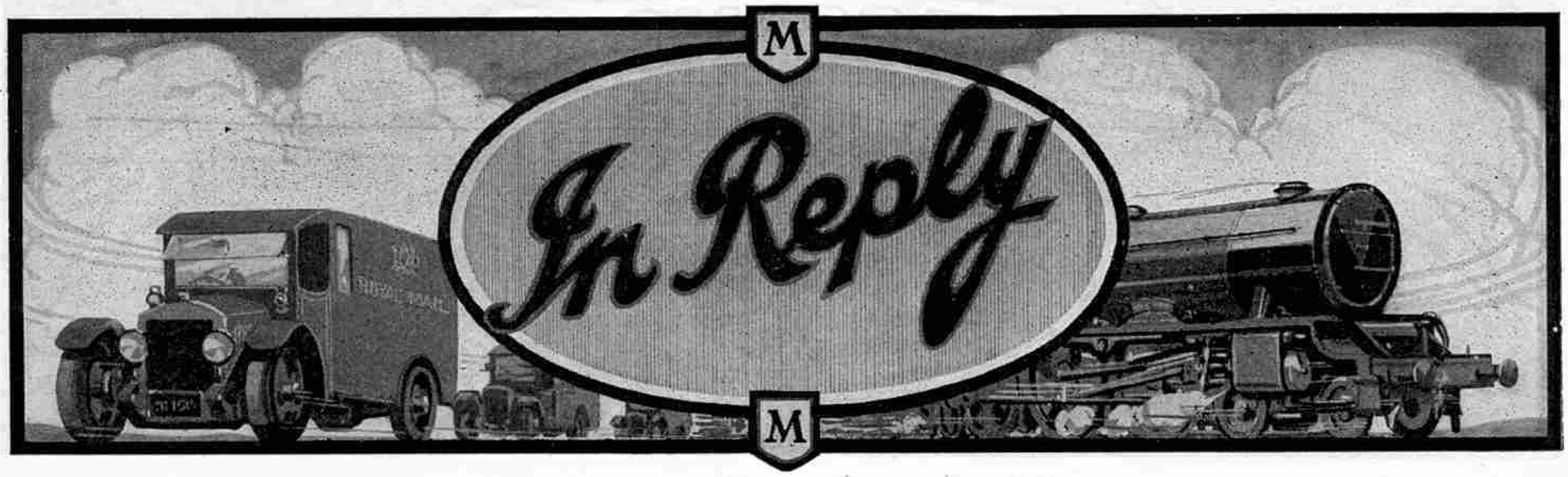


Suggested Hornby Train Improvements

MINIATURE BOOKSTALL.—We are interested in your proposal that we should make a miniature bookstall for the platforms of the Hornby Railway Stations. The present Station incorporates a bookstall, but a separate accessory would be useful, especially at terminal stations, and we will consider the idea carefully with a view to its introduction. (*Reply to R. E. Jones, Colwyn Bay*).

BOGIE MILK VAN.—We are interested in your suggestion that we should produce a Hornby No. 2 Milk Van. The employment of such a vehicle in conjunction with Vans of the present size would enable a realistic "Milk Special" to be run, and we shall consider the idea very carefully. In the meantime we suggest that you use a No. 2 Luggage Van. (*Reply to S. Bradshaw, Capenhurst*).

HORNBY HORSEBOX.—The addition of a horsebox to the Hornby Series probably would prove popular. Its construction would require careful consideration, but we shall keep the suggestion before us. If any decision is made, an announcement will appear in the "*M.M.*" (*Reply to I. Wray, Bedwyn*).

MINIATURE TRAIN AND PLATFORM STAFF.—The introduction of miniature figures for use on Hornby stations and trains would add to the realistic appearance of a layout. We have had the idea before us for some time past and later we may include such figures in our range. (*Reply to G. Flewellen, Swindon*).

WATER FILLERS TO OPEN.—The fitting to the tenders of Hornby locomotives of water fillers that will open to admit the hose of the water tower is an interesting suggestion. Its adoption would lead to an increase of price, but in view of the probable popularity of the fitting the idea will be given careful consideration. (*Reply to J. Moylan, Beaufort*).

YELLOW SEMAPHORES FOR DISTANT SIGNALS.—The practice of indicating distant signals by painting the arms yellow and fitting them with orange lights at night is being increasingly adopted. The question of making this change in Hornby signals is being considered and when a decision to do so is made information will be given in the "*M.M.*" (*Reply to J. M. Smith, Bristol*).

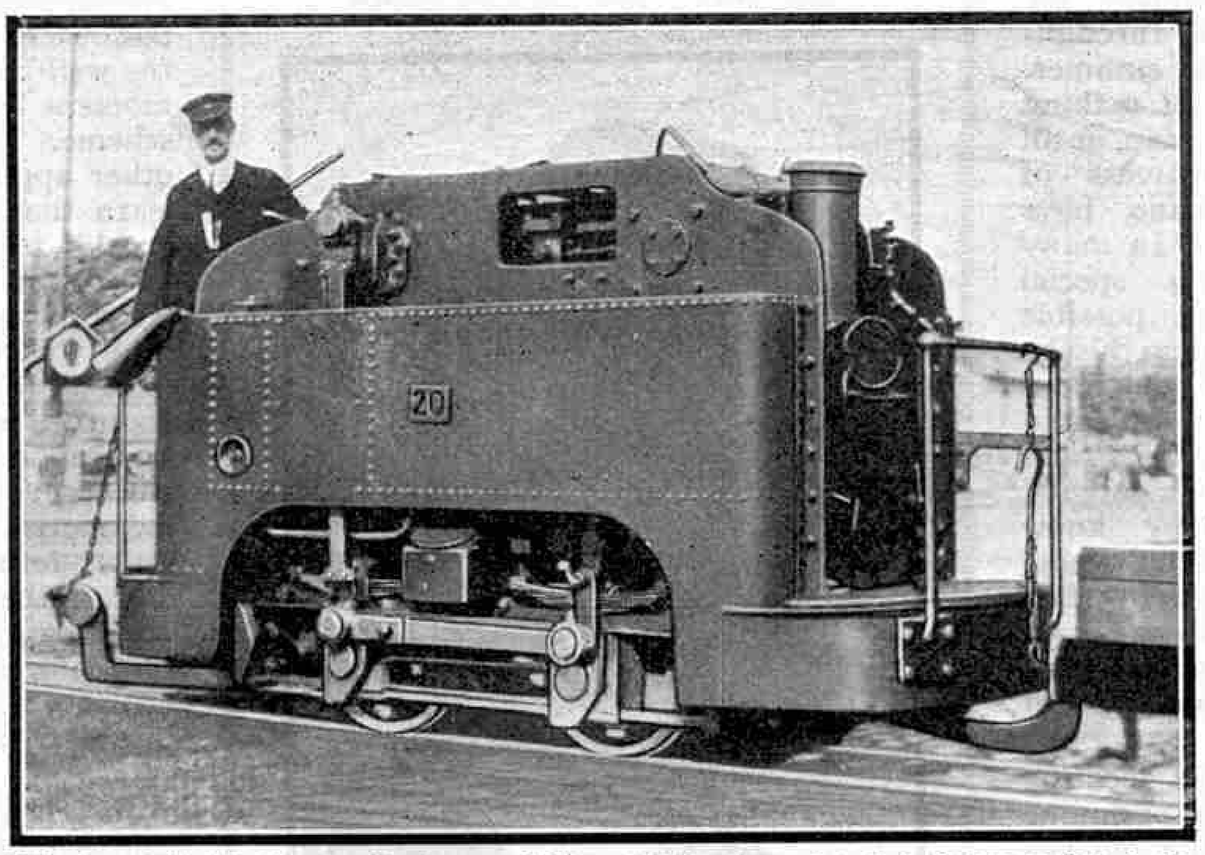
HORNBY RAILWAY "LOG BOOK."—We do not think it necessary to introduce a special log book in which enthusiasts could record the progress of their railways and particulars of various experiments made. Most H.R.C. members keep such a record in a book they consider most suitable for their own circumstances, and the need for a special log book scarcely arises. (*Reply to W. Galloway, Chesterfield*).

LARGER RANGE OF ELECTRIC LOCOMOTIVES.—We are interested in your suggestions that a larger range of Hornby locomotives should be fitted with electric motors, and that a No. 2 Special Locomotive fitted with a permanent magnet motor would be popular. Additions to the present range of Hornby electric locomotives are under consideration, and your ideas will be noted. (*Reply to R. T. Walkley, Barnstaple*).

IMPROVED BREAKDOWN CRANE.—A true-to-type breakdown crane, together with its attendant match truck for supporting the jib, would make a splendid addition to the Hornby Series. Such an outfit would be costly, however, and we do not think the demand would warrant its production. *Reply T. Parker, Winchester*).

THEATRICAL PROPERTY WAGONS.—We are afraid that at present we cannot undertake to manufacture a theatrical scenery wagon. The uses to which a vehicle of this kind may be put are limited, and we do not think a miniature reproduction would prove popular. (*Reply to S. N. Kirkstone, Newcastle-on-Tyne*).

ISLAND STATIONS.—An island station would be an excellent addition to the Hornby System, and as you suggest, would be useful in constructing a large through station. We will keep this suggestion before us and in the meantime we may point out that suitable combinations of the existing stations would suit your purposes. (*Reply to W. N. Crossdale, Bolton*).



This strange-looking locomotive is one of 22 used in the breweries of A. Guinness, Son & Co. Ltd., Dublin. The engine is mounted above the boiler, and side connecting rods from the crankshaft operate the four coupled wheels. The working pressure is 120 lb. per sq. in. and the locomotive can deal with a load of 160 tons.

S.R. BAGGAGE VAN.—We agree that a reproduction in the Hornby Series of the recently introduced baggage vans of the S.R. would be popular with enthusiasts who favour this line. Corresponding vehicles are not employed by the other three groups, however, and therefore we are unlikely to adopt your proposal. The Hornby No. 2 Luggage Van serves the purpose equally well. (*Reply to T. Smythe, Ashford*).

WATER SCOOP ON No. 2 SPECIAL TENDERS.—We do not see what advantage would be gained by fitting dummy scoops underneath the tenders of Hornby No. 2 Special Locomotives representative of companies employing track troughs. The scoop would be out of sight when the tender is in use and easily damaged in the event of a derailment, and these considerations, together with the increase in price that would be necessary, prevent us from adopting the suggestion. (*Reply to W. E. Hewitt, Leeds*).

CONDENSING PIPES ON HORNBY LOCOMOTIVES.—We are interested in your suggestion that condensing pipes should be fitted to certain Hornby tank locomotives. Such pipes are in common use on locomotives that often work through tunnels. We do not think Hornby locomotives fitted with them would be well received, but your suggestion will be carefully considered. (*Reply to S. E. Whitfield, Dulwich*).

BALLAST WAGONS WITH DROP SIDES.—Wagons with low sides would make an attractive addition to the Hornby Series. Vehicles of this pattern are in extensive use in actual practice and we shall consider their introduction when revising our rolling stock. (*Reply to T. Morton, Hereford*).

SUITABLE LOAD FOR HORNBY TROLLEY WAGON.—We are interested in your suggestion that we should provide suitable loads to be carried in the well of the Hornby Trolley Wagon. Such accessories as miniature traction engines would be costly to make, however, and it is doubtful if there would be a sufficient demand for them. (*Reply to C. D. Bennett, Stoke*).

MINIATURE ADVERTISEMENTS.—We agree that a set of metal advertisement plates for attachment to the walls, and other lineside structures would improve the appearance of a Hornby layout. At present their introduction is under consideration. (*Reply to W. S. Francis, Avonmouth*).

L.M.S. (H.R. SECTION) "CLAN" CLASS LOCOMOTIVE.—A reproduction of the locomotives of the "Clan" class would make an interesting addition to the Hornby Series. But since these are comparatively little known, and work only on their own section, we do not think that such a model would be sufficiently popular to justify the expense of introduction, and in any case it could not be introduced until a six-coupled mechanism is available. (*Reply to F. Cornish, Leeds*).

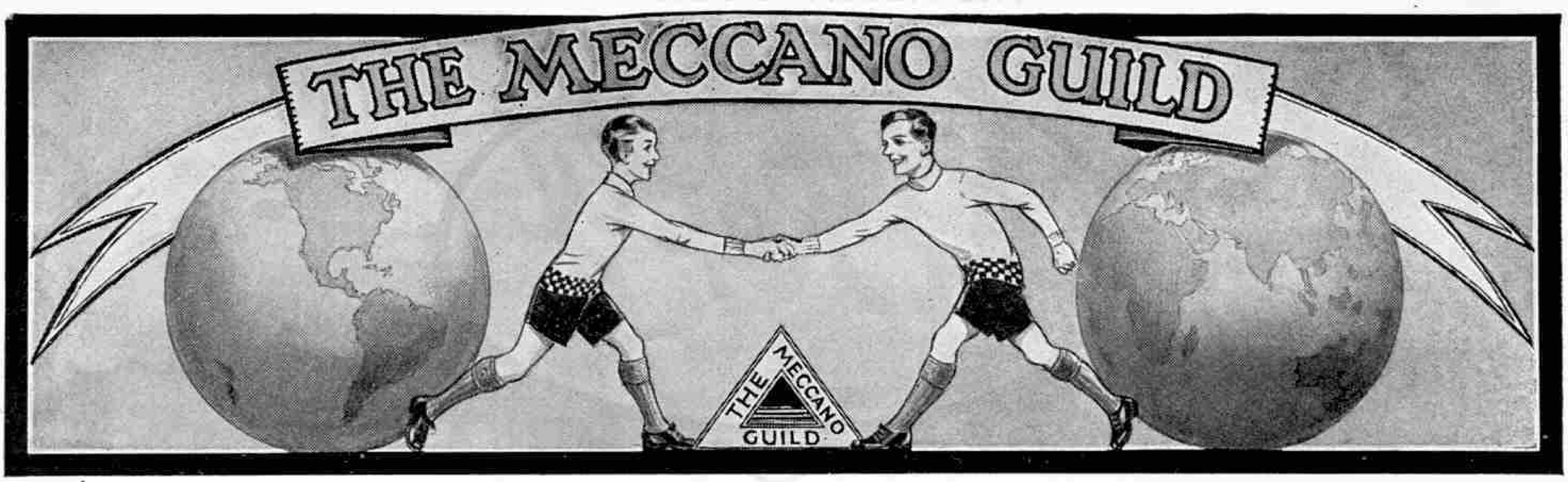
SIX-WHEELED GOODS BRAKE VAN.—A large number of six-wheeled brake vans are in use on our railways, but recent practice tends towards the use of four-wheeled vans of large size. For this reason we are unlikely to make the change you suggest in the design of the Hornby Goods Brake Vans. (*Reply to F. Burridge, Tipton*).

RAILWAY ACCESSORIES.—The mile posts, gradient posts and station name-boards included in the Hornby Series of Accessories may be purchased separately, the first two mentioned being 2d. each, and the nameboards 5d. each. These will meet your requirements. (*Reply to F. W. Pearce, Loughborough*).

FOOTPLATES ON No. 2 SPECIAL TENDERS.—We are interested in your suggestion that flaps should be fitted to the front of the Hornby No. 2 Special Tenders. Their addition would certainly give a more realistic appearance to the footplates of the No. 2 Locomotives and Tenders when coupled together, and the idea is being filed for consideration. (*Reply to G. Weightman, Liverpool*).

MOTIVE POWER IN TENDERS.—Your proposal that mechanisms should be fitted in tenders as well as in Hornby locomotives themselves is interesting, but not at present practicable. We agree that the extra power would be useful, but we do not think that the results would justify the increase in price that would be necessary. (*Reply to F. Thompson, Birmingham*).

WATER SOFTENING TOWER.—This accessory would have an attractive appearance when used in conjunction with a locomotive depot or water tank. Good use is made of this plant on the G.W.R., and a model would probably appeal strongly to enthusiasts for that line. Careful consideration will be given to your proposal, but we do not think that the introduction of such towers is likely, for they may easily be constructed at home. (*Reply to C. E. Blake, Churchill, Oxford*).



With the Secretary

The New Session

I am very glad to know from my post bag that in most clubs the officials have already begun to make preparations for the work of the coming winter sessions. The end of August and the early days of September are by no means too early to be thinking of the programme to be followed. A hurriedly arranged syllabus is sure to bring with it disaster, particularly if it is put together without proper discussion and consideration by the members themselves.

In most clubs little need be done in the way of regaining touch with members, for outdoor meetings have been held throughout the greater part of the summer. But in view of the importance of making a good start, it is an excellent plan in all cases to make a personal canvass of members, and of other Meccano boys who are likely to join the club. In many instances, the Leader makes a special point of visiting members and possible recruits in their homes. By doing this he not only gets in touch with the boys themselves, but also secures a splendid opportunity of explaining the aims and objects of the Guild to their parents, and of making sure that they know exactly what their sons will be doing on club nights. Time spent in doing this is never wasted, for parents who are kept in touch with the progress of a club in this manner invariably become its ardent supporters.

As early as possible a business meeting should be held, at which a programme suggested by the Leader and the officials may be explained and the approval of members asked for. At this meeting members should be encouraged to express any opinions they may have formed on the manner in which the clubs should be run, and they should also be given every opportunity of suggesting new activities. In some instances it may be found that a sudden wave of enthusiasm for a particular hobby has swept over the club. Naturally its adoption is desired, and it is a wise plan to make provision for it. But some of the members may be so keen on it that other equally interesting pursuits may be thrust on one side in its favour. Then is the time when the Leader and other officials should exercise a little diplomacy, for enthusiasm in a club fades away most quickly when there is a lack of variety of interests. New hobbies should be welcomed, but they should be allotted only a fair share of the time available in order that they may not become wearisome to members other than the enthusiasts who introduce them.

Meccano Club Leaders

No. 47. Mr. W. L. King

Mr. W. O. King is Leader of the Hyde Chapel M.C., a club that has made excellent progress since its affiliation in March 1930. An excellent and varied programme is followed, and recently a large party of members enjoyed a tour of the Meccano factory in Liverpool.

Enrolling Overseas Members

In recent months great enthusiasm for the Guild has been aroused in overseas countries, and there has been a remarkable increase in the number of Meccano boys who have joined the organisation. In order to encourage the growth of the Guild in these countries it was arranged some time ago that badges and certificates should be supplied direct by the agents of Meccano Limited in them. This step has been greatly appreciated, for it has resulted in the prevention of the delay that in many instances inevitably occurred in completing the formalities of enrolment. Naturally when an application form is sent to Headquarters from, say, New Zealand, a considerable time must elapse before the badge and certificate can be received in return. To some members the pleasure of obtaining these direct from Headquarters is compensation for the delay, but others who are anxious to be able to wear the well-known badge at the earliest possible moment have taken advantage of the new scheme. Their example may be followed by other applicants, who will be interested to learn that their application forms are forwarded to Headquarters in order that their enrolment may follow.

Secretaries of affiliated clubs in Australia, New Zealand, and South Africa will be pleased to know that our agents in these countries are now able to supply the cards and report forms issued for their use. This will prevent delay in renewing stocks of membership cards, subscription cards and report forms, for the secretary of a club in one of the countries referred to may now obtain supplies within a few days of writing for them, instead of having to wait weeks, as was the case when these could only be procured from Headquarters.

* * * *

In preparation for the coming winter session secretaries should overhaul their supplies of Guild literature and make sure that they have a sufficient number of membership cards and subscription cards to cope with the demand. Further supplies may be had on application to Headquarters, and I shall also be pleased to include with them report forms, Guild application forms, and copies of the leaflet that explains the aims and organisation of the Guild.

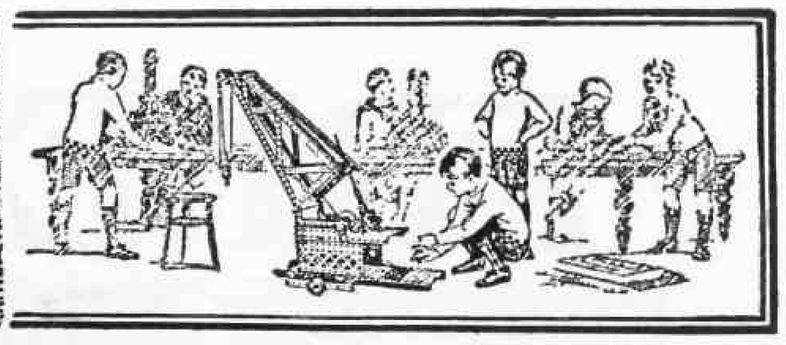
I also wish to remind Leaders that recommendations for Special Merit Medallions for the summer session should be forwarded at the earliest possible moment. Two are allotted to each club and should be awarded to members who during the summer have carried out good work on behalf of the club.

Proposed Clubs

Attempts are being made to form clubs in the following places and boys interested should communicate with the promoters, whose names and addresses are given below:—

AYLESBURY—E. E. Hubbard, 101, Park Street.
BIRMINGHAM—W. L. Munns, 46, Frances Road, Erdington.
BRISTOL—L. Matthews, 94, Montreal Avenue, Horfield.
KING'S NORTON—John E. Wilson, 23, Meadow Hill Road.
MAIDSTONE—Leon Rye, 125, Union Street, Maidstone.
TIVERTON—L. T. Jarvis, Sampford Peverell.

CLUB NOTES



Cranleigh M.C.—Interesting models constructed by members have included several Bridges, a Motor Cycle, and an excellent reproduction of an Electric Coal Cutter. Members helped greatly in making the annual Church Fête a success. The club's Affiliation Certificate has been exhibited in a local shop window, where it aroused great interest. Cricket and other games are being played during the outdoor months, and several Cross-country Runs have been arranged. Club roll: 11. *Secretary:* W. West, Police Station, Cranleigh, Nr. Guildford.

Brades M.C.—In a special Model-building Competition, in which the prizes were kindly given by Mr. W. Howell, the chief award was secured by J. Leedham with a splendid model of a Workshop, complete with Lathe, Drilling Machine and Dynamo. Other prize winners were F. Rudd and L. Goddard, who built a Motor-Cycle and an Electric Crane respectively. A Reading Room has been started and already contains many interesting books and magazines. Club roll: 52. *Secretary:* G. Evans, 148, West Bromwich St., Oldbury, Nr. Birmingham.

Horsforth M.C. — The club has been divided into two sections in order to encourage friendly rivalry among the members. Cricket Matches and Rambles have been the chief summer pursuits, matches between the two sections having been fiercely contested. The large outdoor Hornby Train Layout is a great attraction to members. Club roll: 36. *Secretary:* J. K. Sutcliffe, Atlas House, Horsforth, Nr. Leeds.

The Mall School M.C. — During the summer months Model Aeroplane and Boat Sections have been formed, these usually meeting out of doors. The Stamp and Hornby Railway Sections also have been actively engaged, and Cricket Matches, Visits and Excursions have completed the programme, a specially interesting feature being a match between the Meccano Club and the rest of the School. Club roll: 24. *Secretary*: F. M. Beatty, 23, Oxford Road, Teddington, Middlesex.

Westbury M.C.—A Lecture on "*A Holiday in Blackpool*" was illustrated with excellent lantern slides. The Cricket team has been very successful and a new game in Baseball has been introduced. A Model-building Contest also has been held, and in this some of the prizes were kindly presented by local Meccano dealers. Club roll: 35. *Secretary*: E. D. Move, 24, Burnell Rise, Letchworth.

"Twenty Eight" (Edinburgh) M.C.—Recent activities have included building a club model of the Transporter Bridge. Members not engaged in this task constructed models for Exhibition purposes, these including representations of the "*Rocket*," a Motor Wagon, a Seaplane, a Windmill, and a Steam Driven Paddle Boat in addition to a Meccanograph. During the summer one Cycle Run and one Ramble are being held monthly. Club roll: 11. *Secretary:* Mr. J. M. Ferguson, 7, Roseneath Terrace, Edinburgh.

Bury Municipal Secondary School M.C.—Lectures have been given on "*How a Motor Cycle Works*" and on "*British and Foreign Merchant Liners*," the former being illustrated by a practical demonstration on the Leader's machine. A talk also has been given on "*How a Locomotive Works.*" On Model-building Evenings splendid models of several Motor Chassis have been constructed, and a reproduction of Mr. Kaye Don's racing car "*The Silver Bullet*" is deserving of special notice. Club roll: 12. *Secretary:* R. K. Greenhalgh, 244, Ainsworth Road, Elton, Bury, Lancs.

Alton M.C.—Recent events have included a short Lecture on "*Stamp Collecting*," and impromptu talks by members on engineering subjects. A large club model of a Funicular Railway was built for display at a local Arts and Crafts Exhibition. Members pooled their resources in order to build the model, which was electrically driven and worked continuously, the direction of the train being reversed automatically when necessary. The excellent plan has been adopted of having an out-of-door games period before each meeting when weather permits. Club roll: 24. *Secretary:* G. Chesterfield, 82, Normandy St., Alton, Hants.

Belgrave M.C.—A "Motor Show" has been held. Prizes were awarded for the best models of motor cars exhibited, and a splendid variety of entries was obtained. Interesting lectures have been given on "*Pressure Appliances in Engineering*" and "*Aircraft, of To-day.*" Club roll: 9. *Secretary:* K. J. Hatfield, 25, Acorn Street, Leicester.

Burgess Hill M.C.—Models were exhibited at the local "Arts and Crafts" Exhibition, members being very successful in winning prizes. A Silver Medal presented by the President of the Exhibition was awarded to E. S. Young, for his model of a Circus Traction Engine. Other models exhibited included Racing Cars, Tractors, a Reaping Machine and Seaplanes. Visits have been paid to the local Gas Works and other places of interest, and lectures have been given by the President on "*Butterflies and Moths*" and by a member on "*Stamp Collecting.*" Club roll: 13. *Secretary:* Geo. Lineham, Marlborough House, Royal George Road, Burgess Hill.

Constantine (Falmouth) M.C.—A successful outdoor Concert was given at a Fête in aid of the Church. Outdoor sports and recreations have been carried on during the summer, the president, Rev. F. Monger, presenting cricket material and Mr. J. J. Medlyn kindly allowing the club the use of a field. Club roll: 10. *Secretary:* L. H. Vague, Constantine, Falmouth.

Laindon M.C.—This recently affiliated club is making good progress. Model Building is the chief pursuit, and stations and other accessories have been built for use in connection with the Hornby Train Layout. This represents a local section of the L.M.S., and interesting timetable working has been carried out on it. A lecture on "*Railway Operations*" was given by the Leader. Club roll: 12. *Secretary:* J. P. Tourle, "St. Ives," Leicester Road, Laindon, Essex.

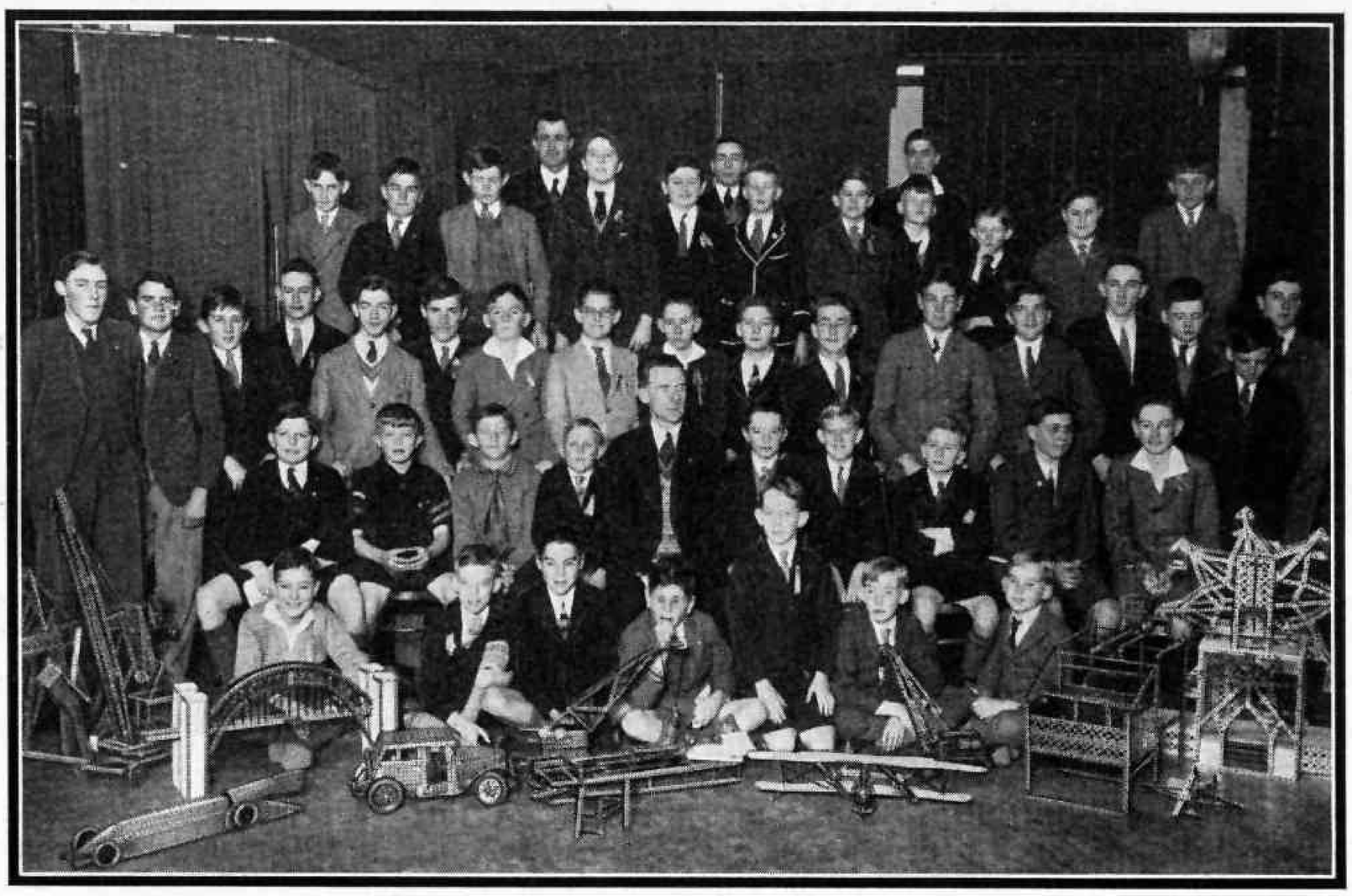
Greenford M.C.—At the Exhibition the models shown included Horizontal Engines and a Meccanograph, and a Hornby Train layout also was on view. A profit of more than £1 was made, although prices of admission were only a 1d. and 2d. Cricket and Sports Meetings have been held during the summer, but model-building evenings also have been held, models constructed including Cranes, Bridges and Motor Cars. An outdoor Hornby Railway also has been constructed in a field. Club roll: 20. *Secretary:* C. Howe, 145, Coston's Lane, Greenford.

Great Baddow M.C.—At the Concert, which was very successful, the sum of £7 10s. 0d. was raised. The Jumble Sale also was highly successful, and from the funds raised in this manner the expenses of the annual trip to Colchester were paid. Through the kindness of Mr. and Mrs. S. Beale the club has acquired a Cricket outfit and has been allowed the use of the ground of the local Cricket Team for practices and games. Club roll: 47. *Secretary:* Miss D. French, High Street, Great Baddow.

Holy Trinity (Barnsbury) M.C.—On Model-building evenings special attention is paid to the uses of various parts. Thus at one meeting the uses of Pulleys and Gear Wheels is dealt with, at others Electrical models are built or the purposes of the most recently introduced parts are illustrated. The gross proceeds of the sixth annual Concert were over £5 10s. 0d. Parents' Night, when prizes were presented, was the most successful for some time. Mr. D. E. Stretton, Assistant Leader, has been seriously ill, but happily is now recovering. Club roll: 51. *Secretary:* Mr. F. Randall, 43, Ripplevale Grove, Barnsbury, N.1.

Pharos (Dover) M.C.—The Meccano Exhibition at the School Bazaar was very successful. A large number of excellent models were displayed, and a realistic Hornby Railway layout attracted admiration. During the summer months members were engaged in preparations for the School Sports. Club roll: 33. *Secretary:* S. E. Teasdale, 21, East Cliff, Dover, Kent.

Selwood House School M.C.—Interesting meetings have included a Musical Evening, a Stamp Night and Hornby Train Evenings. A Motor Car Test has been held. Models constructed by members were compared in regard to their running and hill-climbing capacities, and were tested for strength by being made to jump off the raised end of a plank. Club roll: 25. *Secretary:* F. G. A. Ashby, Selwood House School, Falmouth.



A merry group of members of the 2UW (Sydney) Meccano Club. This club has been established in connection with the 2UW Broadcasting Station and is under the Leadership of Mr. C. J. Arnold, who is shown in the centre of the above illustration. The programme of this station includes two Meccano Hours weekly. Our photograph was taken on the occasion of a highly successful Exhibition and Social Evening.

INDIA

Lahore M.C.—A lecture on steam engines was given by members of the club to students, this being illustrated by means of a model of a Vertical Steam Engine. A Garden Party has been held, and a lecture given by the Leader on "*Engineers and their Works.*" In Model-building Competitions the prizes were given by Mr. S. K. Singh, President of the club, who also has placed a cottage in the hills at the disposal of members. Club roll: 13. *Secretary:* Karpal Singh, 6, Nisbet Road, Lahore, India.

NEW ZEALAND

Hawera M.C.—Talks on the Navy, Wireless Telegraphy and the Gallipoli Campaign have been given. A model has been constructed of an anti-aircraft gun, a new Meccano Outfit owned by the club being used for this purpose. Miniature Rifle Shooting is popular with members, and contests are held regularly. Club roll: 16. *Secretary:* Arthur Brooks, 35, Burn Street, Hawera.

FREE! MODEL AEROPLANES

SEND NOW!

Jim is delighted with the "Force-plane" he has just made.

HOW TO GET A "SUNNY JIM" FORCE-PLANE

The fully coloured diagram (size 10″ × 22″) from which you can make this jolly model aeroplane, can be obtained by sending *one top from a "Force" packet*, with the coupon below, and a 1½d. stamp to cover postage.

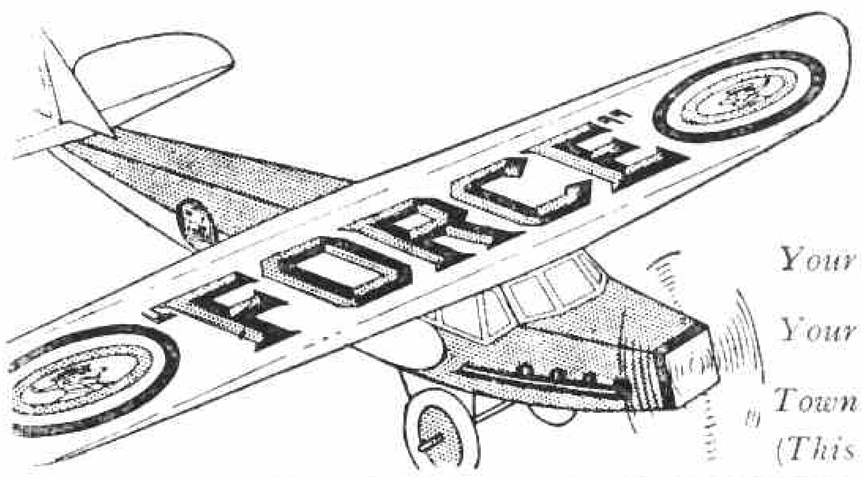
You are missing fine fun every moment you delay sending for this splendid model. In bright, attractive colours, it is a replica of the Desoutter coupe and will glide easily twenty to thirty feet. It performs also many of the stunts in which our intrepid air-pilots excel.

A "Sunny Jim" Force-plane enables you to imagine what it is to be a pilot of an Air Liner. His iron nerve depends upon his perfect health.

Be sure that *you* never "crash." The best way to keep "tuned up" for the longest journey is to eat "Force" and milk for breakfast every day. Ask Mother to get you this delicious whole-wheat food for to-morrow's breakfast. You'll soon see how good it is. It makes you feel bigger—brim full of vigour. And you can send the packet top for your "Sunny Jim" Force-plane.

CUT THIS OUT

COUPON *for* FREE MODEL AEROPLANE



To SUNNY JIM, Dept. F.P.6, A. C. Fincken & Co., 197, Great Portland Street, LONDON, W.1.

Please send me, free, a "Sunny Jim" Force-plane. *I enclose a 1½d. stamp for postage and one top from a "Force" packet.* (Tops from Sample packets are not accepted.) This offer closes on Sept. 15th, 1930.

Your Name.....

Your Address.....

Town.....

(This offer applies in Great Britain, Northern Ireland, and the Irish Free State only)

Competition Page

DOUBLETS

The "Doublets" Competitions that were held in the "*M.M.*" some three years ago were among the most popular word competitions that we have ever set, and in reintroducing them at the request of several readers we have no doubt that they will be welcomed very warmly by the majority of readers. They are, indeed, a fascinating test of nimble-mindedness.

For the benefit of new readers we repeat the rules governing these fascinating word puzzles.

Two words, each containing the same number of letters, are given, and are termed the Doublet. It is required to change the first word into the second by placing connecting words between the two, each new word differing from its predecessor by the alteration of one letter only, and without any shuffling of the letters. These connecting words are called "links," and the object of the contest is to effect the necessary change from one word of the doublet to the other with the smallest possible number of links. As an illustration we give the following examples.

Change COLD to HEAT
COLD—hold—held—head—HEAT
Make LION ROAR
LION—loon—loan—roan—ROAR

Competitors should note that in making the links only English words appearing in a standard dictionary may be employed. Proper nouns—names of persons, places, etc.—are not permitted. The doublets that are to be solved are as follows:—

Part	HAIR	with	COMB
Build	SHED	from	PLAN
Ride	BIKE	to	TEST
Change	OLDER	to	NEWER
Dip	PEN	in	INK
Fly	PLANE	to	PARIS
Drain	RIVER	from	MARSH
Draw	GAS	from	AIR
Break	WAVE	to	SURF
Extract	TIN	from	ORE
Cut	GRASS	with	MOWER

Meccano or Hornby Train goods to the value of £1/1/–, 15/– and 10/6 respectively will be awarded to the senders of the three solutions showing the lowest total of links used. In addition there will be a number of consolation prizes for the entries next in order of merit. In the event of a tie for any of the prizes, the neatest or most novelly prepared entries will be preferred.

Entries should be addressed to "Doublets, Meccano Magazine, Binns Road, Old Swan, Liverpool," and sent to reach this office not later than 30th September. Overseas closing date, 31st December.

September Photographic Contest

With this issue our Photographic Competitions come to an end for the season, and it is, therefore, of interest to review the outcome of our decision not to set particular subjects for the competitions this year, but to permit the submission of photographs of any subject for any competition. Readers will share our pleasure when they know that the number of entries this year has averaged rather more than three times that for last year, a result that, in all the circumstances, must be considered as really splendid, and ample justification of our policy.

The competition this month will follow the lines of the previous contests of this year, and prizes will be awarded for the best photographs submitted, irrespective of the individual subjects.

The entries will be divided into two sections, A for those from readers aged 16 and over, B for those from readers under 16. Prizes of photographic materials or Meccano products (to be selected by the winners) to the value of 21/– and 10/6 respectively will be awarded to the best and second-best entries in each section.

Entries should be addressed to "September Photo Contest, Meccano Magazine, Binns Road, Old Swan, Liverpool," and must be sent to reach this office not later than 30th September. Overseas closing date, 31st December.

Stamp Competition

In the view of many people, not all of whom are stamp collectors, the British air mail services would be supported much more keenly by the public if more assiduous efforts were made to keep the air posts prominently in the public eye, and for a considerable time there has been going on a quiet agitation for the introduction of a distinctive British stamp for use on correspondence sent by air mail, as one of the simplest and most effective advertising methods available. The official attitude, as reported in our Stamp Gossip columns this month, takes the view that such an innovation would have a bad effect.

We must confess we cannot follow the official mind, but possibly there are arguments that we have overlooked and it would be interesting to have our readers' views on the question whether a British Air Mail Stamp would be desirable or not.

Prizes of stamps, or stamp collecting accessories, (to be chosen by the winners from the catalogues of our stamp advertisers), to the value of £1/1/–, 15/–, 10/6 and 5/– respectively, will be awarded to the senders of the four best letters on the subject, in order of merit. In addition there will be a number of consolation prizes for the next best entries. In the event of a successful competitor not being a stamp collector he may take his prize in the form of Meccano or Hornby Train products, to be chosen as he desires from our publishers' current catalogues.

Letters must not exceed 250 words in length. They should be addressed to "Stamp Editor, Meccano Magazine, Binns Road, Old Swan, Liverpool," and the envelope marked "Air Mail Contest" in the bottom left hand corner. Letters must reach this office not later than 30th September. Overseas closing date, 31st December.

Competition Results

June Photo Contest.—First Prizes: Section A, G. S. Marsh (Blackpool); Section B, L. G. Caudell (Dartmouth). Second Prizes: Section A, F. Rhodes (Bradford); Section B, G. B. Coles (London, N.14). Consolation Prizes: F. G. Clements (Luton, Beds.); J. Haylett (Loughton, Essex); R. W. Haw (Darlington); T. P. Lynott (Birmingham); G. Rae (Edinburgh).

Cricket Voting.—1. G. W. Jenkinson (Sheffield); 2. G. Raymond (Tottenham, N.17); 3. J. E. Druce (Shrewsbury); 4. (Joint) E. H. Carpenter (Addlestone, Surrey); R. E. Davies (Kingsbury, N.W.9). Consolation Prizes: J. Brooks (Manchester); D. Chalk (Bexhill-on-Sea); E. A. Dadswell (Maidstone); S. Douglas (Kilwinning, Ayrs.); E. A. Fenn (Southend-on-Sea); A. Gould (Belfast); R. A. Jones (Southend-on-Sea); A. J. McDonald (Birmingham); G. Nicholson (Glasgow, W.1); E. J. Robinson (Burton-on-Trent); H. L. Rose (Aberdour, Fife); J. K. Sutcliffe (Horsforth, Nr. Leeds).

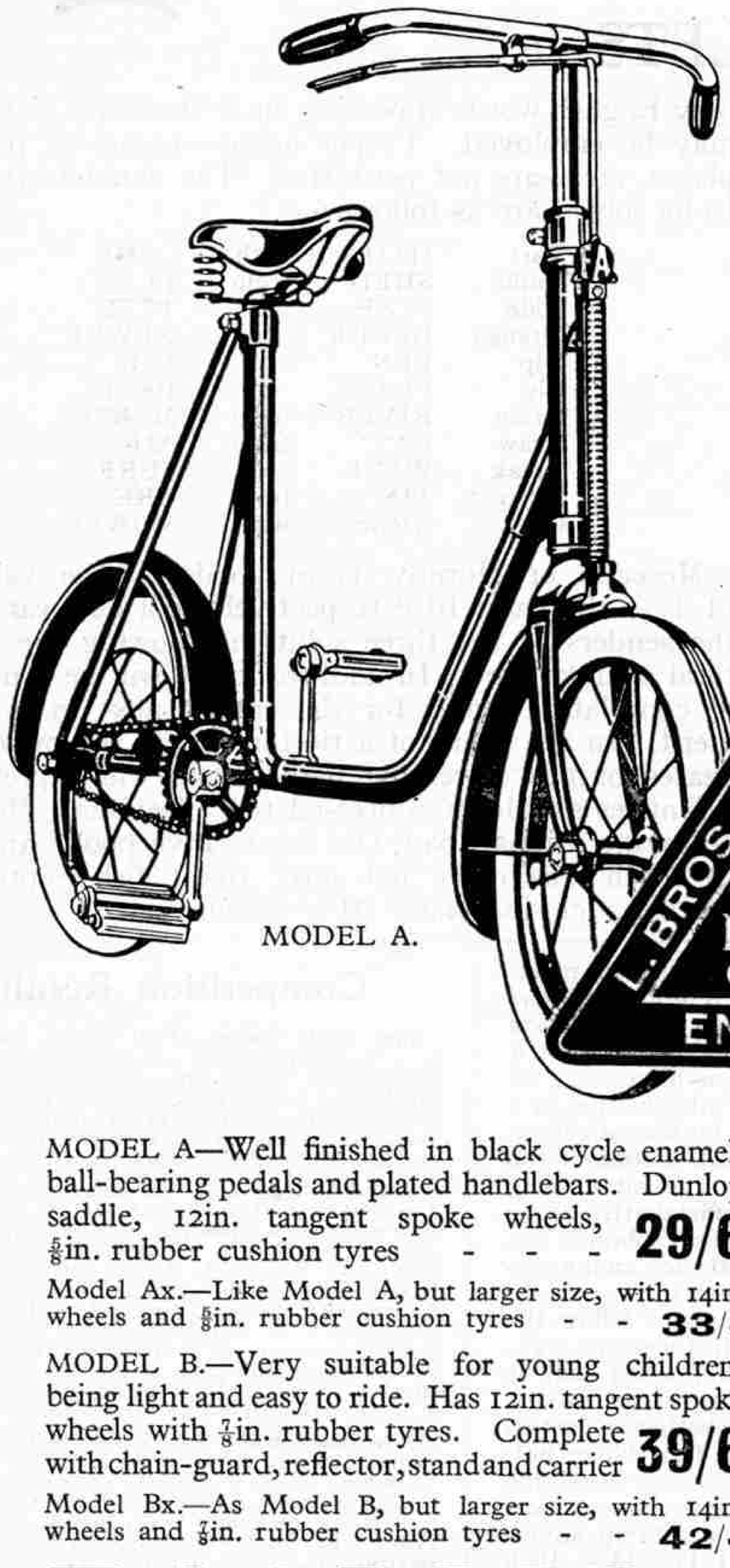
July Photo Contest.—First Prizes: Section A, W. H. Foster (Bingley, Yorks.); Section B, G. M. Lane (Wakefield, Yorks.). Second Prizes: Section A, C. W. Gwilliam (Gateshead-on-Tyne); Section B, J. Baldwin (St. John's Wood, N.W.8). Consolation Prizes: R. Blewett (Praze, Cornwall); T. H. Braithwaite (Guildford); F. G. Clements (Luton, Beds.); R. Herbert (Bowes Park, N.11); W. N. Holland (Coulsdon, Surrey); L. Hope (Weston-super-Mare); R. I. Macdonald (Glasgow, S.2); G. S. Marsh (Blackpool).

Cut Outs No. 2.—First Prizes: Section A, V. C. Kaile (Mayford, Nr. Woking); Section B, W. S. Butcher (Coventry); Second Prizes: Section A, H. MacRobert (East Hilbride); Section B, W. Smith (Brownhills, Nr. Walsall). Consolation Prizes: C. T. Butcher (Coventry); J. J. Cockburn (Bolton); R. B. Cockburn (Bolton); J. Greene (Clapham Park, S.W.4); P. Healy (Cobh); G. Howes (Southend-on-Sea); C. A. Richardson (Leeds); C. Salmon (Retford); F. Sutton (Stroud Green, N.4); J. M. C. Watson (Bristol); L. A. J. White (Chard, Som.).

OVERSEAS

Figure Face.—The total of the figures employed in the drawing in this contest was 1207. The prizes were awarded as follows:—1. W. G. Hobbs (Pretoria, S.A.); 2. B. L. H. Poole (Vancouver, B.C.); J. Fisher (Canterbury, N.Z.); 4. P. R. A. Glennie (Stellenbosch, S.A.). Consolation Prize: R. T. Brinsley (Sutherland, N.S.W.).

Boys! Here's your idea of a bike

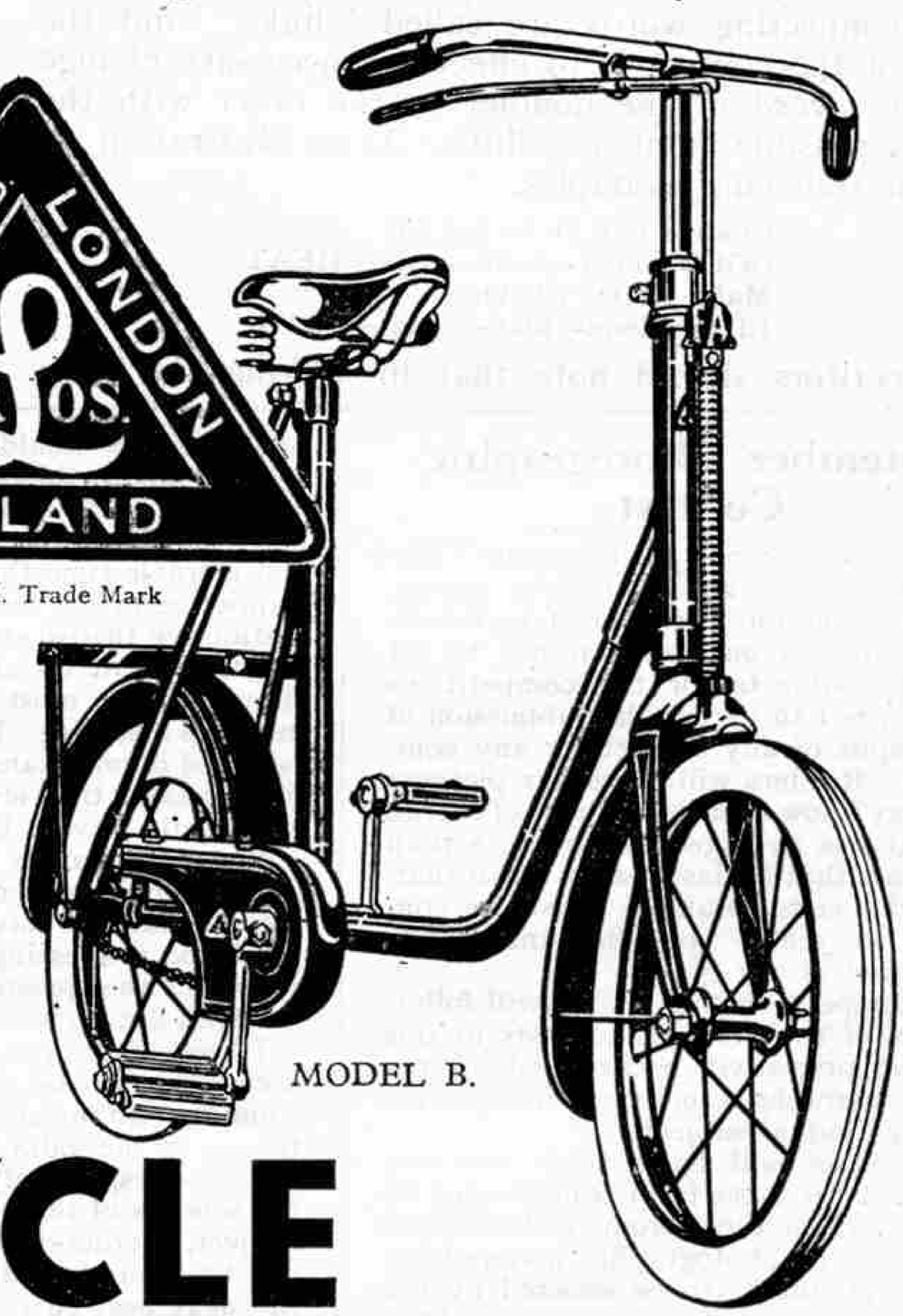


MODEL A.

Here is the Fairycycle. What a handsome bike! Glittering plated handlebars and glossy enamelled frame. What a sturdy bike! Yes, it's built of steel tubing and has tangent spoke wheels. The Fairycycle, you see, is made by skilled engineers. They have fitted it with a chain-guard, a stand, a carrier for your school books and, of course, a reflector and bell. These engineers say: "That's our idea of a good bike." Now isn't it also yours?

L. BROS. LTD. LONDON BROS. ENGLAND

Regd. Trade Mark



MODEL B.

MODEL A—Well finished in black cycle enamel, ball-bearing pedals and plated handlebars. Dunlop saddle, 12in. tangent spoke wheels, $\frac{5}{8}$in. rubber cushion tyres - - - **29/6**

Model Ax.—Like Model A, but larger size, with 14in. wheels and $\frac{5}{8}$in. rubber cushion tyres - - **33/-**

MODEL B.—Very suitable for young children, being light and easy to ride. Has 12in. tangent spoke wheels with $\frac{7}{8}$in. rubber tyres. Complete with chain-guard, reflector, stand and carrier **39/6**

Model Bx.—As Model B, but larger size, with 14in. wheels and $\frac{7}{8}$in. rubber cushion tyres - - **42/-**

FAIRYCYCLE

Besides the models specified above, Fairycycles are made in the following sizes at the prices stated:—

Model C.— Raised pattern plated handlebars, has chain guard, stand, carrier, reflector and bell. Cycle pattern rim brake, 12in. tangent spoke wheels, adjustable ball-bearing hubs, 1in. imitation pneumatic tyres - **49/6**

Model Cx.—As Model C, but larger size with 14in. wheels. **52/6**

Model Px.—As Model Cx, but with 14in. x 1$\frac{3}{8}$in. Dunlop "Kempshall" pneumatic tyres. **55/-**

Model D.—Cycle type brakes, raised pattern plated handlebars, 2-coil spring saddle, etc. $\frac{1}{2}$in. x $\frac{1}{8}$in. roller chain, adjustable ball bearings throughout. 12in. tangent spoke wheels with 1in. imitation pneumatic tyres, complete with chain-guard, stand and carrier, reflector and bell. **59/6**

Model 6.—Strongly built for children up to 9 or 10 years old. 16in. tangent spoke wheels, fitted 1in. imitation pneumatic tyres, adjustable ball-bearings throughout, cycle pattern rim brake, 3-coil spring saddle, tool bag, bell, etc. - - - **70/-**

Model 8. — The "Rolls-Royce" of Fairycycles, raised pattern plated handlebars, 2$\frac{1}{4}$in. buttress tread Dunlop balloon tyres. Plated ball-bearing pedals, tool bag, carrier, stand, bell, reflector and pump, etc. ... **87/6**

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LINES BROS. LTD., MORDEN ROAD, MERTON, LONDON, S.W.19

Fireside Fun

A DILIGENT GUARD

The express was about to start when an old lady ran on to the platform in breathless haste. The guard pounced upon her in a trice, fairly lifted her into a carriage, and as he slammed the door the train moved out of the station.

The first stopping-place was sixty miles down the line. When the train arrived the guard saw the old lady getting out of her carriage in a state of great indignation.

"You almost missed it, ma'am," he said.

"Missed it!" burst out the old lady. "I only wanted to post a letter in the late-fee box on the train!"

* * * *

Boastful American Visitor (as "Flying Scotsman" dashes through small station): "Gee, she's movin'—but is that your fastest train?"

Fed-up Englishman: "No; she's only shunting—she'll be back again in a minute!"

* * * *

"Well, Miranda," asked the minister of a coloured woman whom he met in the local station, "where are you going?"

"I'se goin' nowhere, massa," she replied, "I'se been where I'se goin'."

* * * *

An Irishman trespassing on the line was knocked down by a shunting engine. First-aid men were quickly rushed to the spot, and when the bandaging was done, Pat heard the foreman say, "Now take him to the station."

Pat struggled up. "The station!" he cried. "And what do you want to drag the police in for? If I've damaged your rotten old engine, I can pay for it, can't I?"

* * * *

Mrs. Flanagan: "An' was your old man in comfortable circumstances when he died?"

Mrs. Murphy: "No, 'e was 'alf way under a train."

* * * *

TWO-WAY TRAFFIC

The porter was struggling hard to get a big crate through the doorway of the luggage van. He was entirely unaided, and the thing was stuck half-way.

"Here," said an obliging passenger, "I'll give you a hand. Wait a second."

He jumped over the top of the crate and took the other side. For five minutes they struggled on, till at last they both stopped from sheer exhaustion.

"It's no good," said the porter; "the blessed thing won't go in."

"In!" cried the helper. "I thought you were trying to get it out!"

* * * *

"Did I hear you say, conductor, that there was a locomotive at the rear of the train?"

"Yes, ma'am. We've got a locomotive at each end. It takes an extra one to push up the mountain."

"Dear, dear, what shall I do? It makes me ill to ride with my back to the locomotive."

MISSING!

The engine came noisily to a standstill at the country station.

"Where's your tail lamp?" demanded a porter standing nearby.

The driver looked round and a look of bewilderment came over his face. "Tail lamp be blowed," he said, "Where's my train?"

* * * *

The train was due to start when a small boy ran up to the ticket inspector and whispered: "Sir, there's two men on that train without tickets."

The inspector searched the carriages in vain, and then, seeing the informer standing near, inquired: "Where are they?"

"On the engine!" replied the boy, making rapid tracks for the exit.

* * * *

STOOD FOR YEARS

"I've been travelling on this line for three years, and I've never given my seat to a lady."

"Haven't you got any manners?"

"It isn't that; I've never had a seat."

* * * *

A distinguished personage was seated in the railway compartment, when a fellow passenger leaned forward and gazed earnestly at him.

"Pardon me, sir," he said, "but I seem to know your face."

"Ah! yes, no doubt," said the other, "but I'm travelling incog."

"Really," said the inquisitive passenger. "And I travel in toffee!"

* * * *

Donald (to wife at railway station): "What! Ye canna get a porter tae tak oor luggage?"

Wife: "Na, na. Ye try, Donal', ye're accent's no' quite sae noticeable."

* * * *

Passenger: "Why are we so late?"

Porter: "Well, sah, de train in front is behind, and we was behind before besides."

* * * *

THE TRAIN BR(E)AKER'S FEAT

The famous athlete was being interviewed.

"Just look at this muscle," he said. "With this arm I can stop a train." He paused, and the interviewer registered a look of amazement.

"Yes," continued the athlete, "you see, I'm an engine-driver."

* * * *

The train thundered into the station. Immediately the window of a darkened compartment was lowered and the head of an infuriated gentleman appeared.

"Hi, there," he roared to a passing porter, "the lights in here have failed; mend them!"

"And what do you think I am—a blinkin' electrician?" was the amazed official's prompt retort.

"And what about us?" shouted the enraged passenger as the train commenced to move again. "Do you think we are glow worms?"

* * * *

"Ticket, sir!" said the inspector at the railway station to a gentleman who, having been a season ticket-holder for a number of years, thought his face was so well known that there was no need for him to show his ticket.

"My face is my ticket," replied the gentleman, a little annoyed at not being recognised.

"Indeed," said the inspector, rolling back his sleeve. "Well, my orders are to punch all tickets passing on to the platform."

RAILWAY EXTENSION

A long-distance train in America was behind its time-table, and a traveller asked a Negro conductor the cause.

"Well, sah," said the Negro, who was very proud of the railway on which he was employed, "at night it am so cold dat dey can't keep up steam in de locomotive, and during de day de sun am so hot dat de rails expand and push de towns farther apart."

* * * *

It was on a small country line, and the old engine was toiling along about twenty minutes behind time. An officious stationmaster walked up to the driver when the train came to rest at one station.

"Now then, carn't tha go any quicker na that?' he demanded.

"Ah can," came the reply, "But ahm not allowed to leave t' train."

* * * *

USEFUL KNOWLEDGE

School Inspector: "Would any of you boys like to ask me a question?"

Pupil (fed up): "Please sir, what time does your train go?"

* * * *

"I want to return to the City on a late train."

"Well, I'd recommend the 5.59; she's usually as late as any of 'em."

* * * *

A guard employed by an American railway company had been reprimanded by headquarters on account of the length of his reports. He was naturally somewhat annoyed, and decided next time to err on the side of brevity. Accordingly, his next report read: "Offagin. Onagin. Awayagin. Finnigan."

* * * *

"This is the weapon the accused inflicted the fatal blow with, your Honour."

"But that's only an ordinary currant bun, isn't it?"

"Well, hardly an ordinary bun, your Honour; it's a railway refreshment room bun."

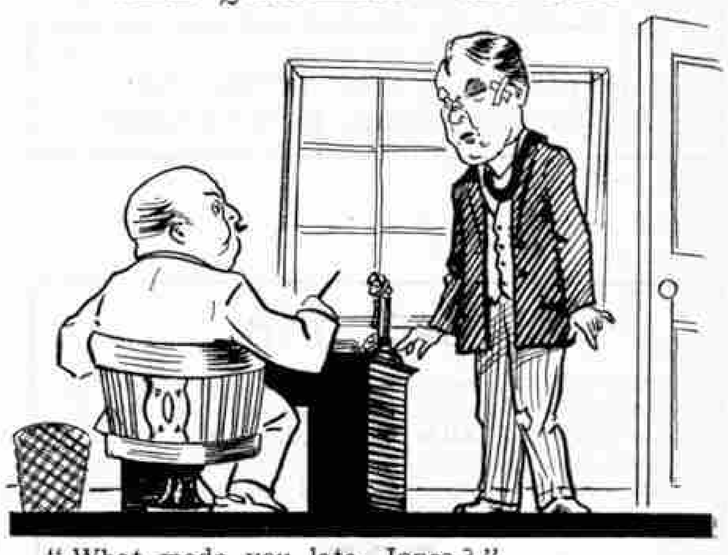
* * * *

It was in the early days of railways, and, on encountering a steep gradient, the hard-worked locomotive came to a noisy standstill. Before the passengers had time to get alarmed, the guard ran along the side of the train.

"First class passengers, please remain seated. Second Class passengers, get out and walk. Third class passengers get out and help push the train up the hill!" he shouted.

* * * *

THE QUICKEST WAY OUT



"What made you late, Jones?"

"I fell out of the train, sir."

"Well, that ought not to have taken you long.'

* * * *

The train drew in at the station and a passenger threw a banana skin out of the window on to the platform.

"Hi, sir," shouted the guard. "The company won't have this, you know."

"Well, divide it amongst the porters," was the reply.

* * * *

"I say, there's five trunks out there to stick these on an' there's only four labels!"

"Then throw away one of the trunks!"

* * * *

Booking Clerk: "Where to?"

Sailor: "I mustn't tell you. I'm sailing under sealed orders."

SG

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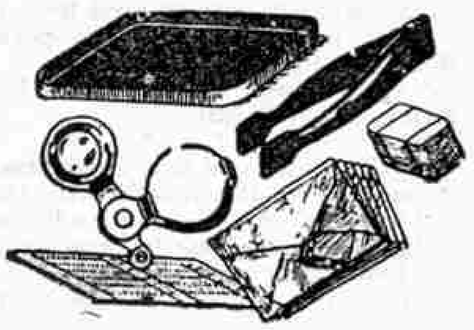
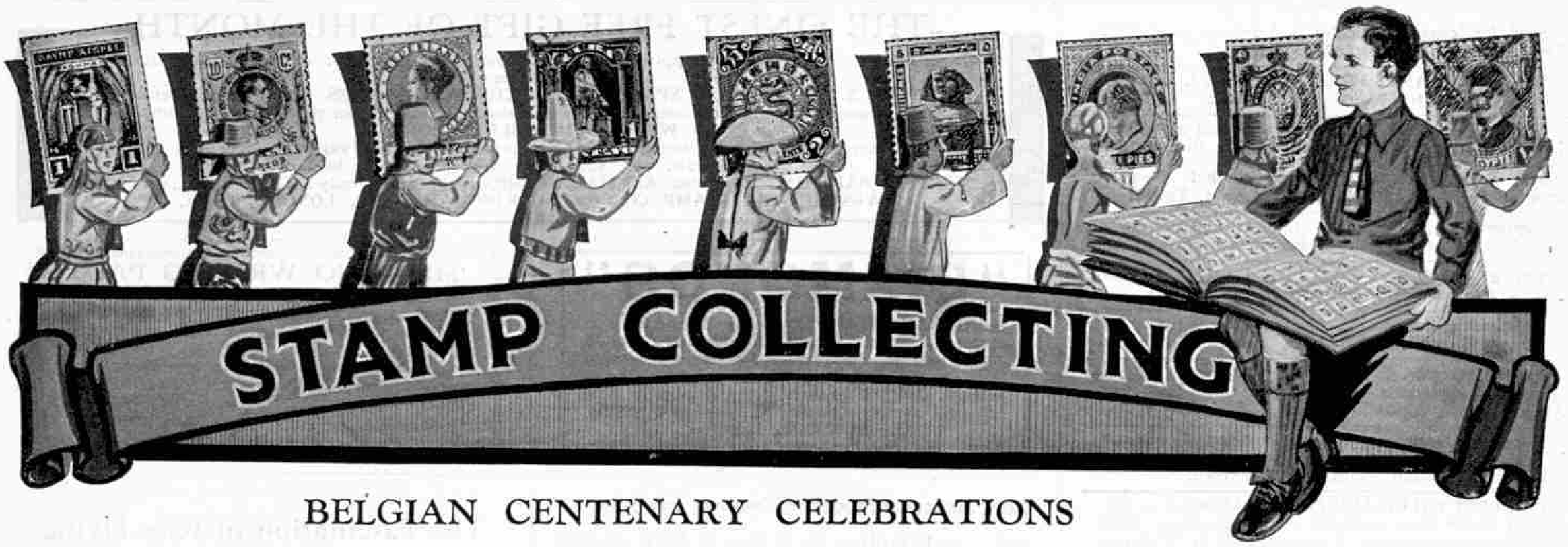




BELGIAN CENTENARY CELEBRATIONS

IN addition to the Antwerp and Liege Centennial exhibitions commemorative stamps, described and illustrated in the *"M.M."* last month, Belgium has issued another short series of stamps commemorating, in a more general way, the centenary of its independence. The series consists of three stamps each bearing the portrait of one of the three Kings whose combined reigns have covered the century during which the country has been an independent State.

Few countries have had so unsettled a history as Belgium. Prior to its creation as an independent monarchy in 1830, it had been tossed about between the Dutch, Austrians, Spanish and French as a mere counter in the realm of international politics. From 1621 to 1713 it was Spanish property, although the wars that were being waged almost incessantly in that period, between Holland, France and Spain, resulted in big slices of territory passing into the hands of the Dutch and French.

In 1713 Belgium was ceded to Austria, Holland, however, retaining a voice in the administration of the country. By 1801 France had gained complete possession. The fall of Napoleon in 1814 brought a further, but temporary, Austrian regime until 1815, when the Congress of Vienna turned Belgium over to Holland and placed Prince William Frederick of Nassau on the throne as King of the Netherlands. The Union was unfortunate, for Belgium and Holland had very little in common. The temperaments, habits and, most important of all in that era, the religions of the two peoples were completely in opposition, and it was not surprising that the Belgians displayed open dissatisfaction.

Even so, all might have been well had Holland adopted a conciliatory policy in its administration of Belgium, but, unfortunately, the Dutch attitude was quite the reverse. Although the population of Belgium was nearly 3½ millions and that of Holland only 2 millions, the preponderance of representation in all matters of State lay with the Dutch; only one of seven Ministers of the Crown was Belgian; in the ministry for internal affairs 117 of 128 officials were from the northern Kingdom; in the ministry for war 102 of 105 was the Dutch quota; while in the National Army only 288 of 1,967 officers were Belgian! Belgium, was, in fact, treated as a conquered country to be administered solely for the benefit of its masters.

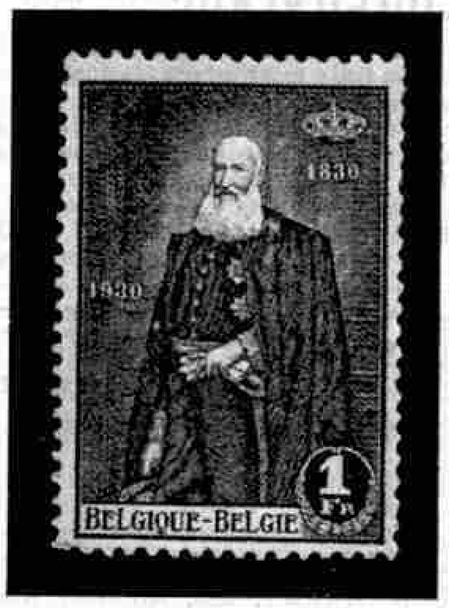
Nevertheless, it must be recorded that Belgium prospered under Dutch domination and it was the constant clash of religious views that led ultimately to the throwing off of the Dutch yolk and the establishment of Belgium as an independent monarchy in 1830, with the approval of the great European Powers.

Leopold, Prince of Saxe-Coburg, was elected first King of the Belgians, and it is his portrait that appears on the 60c. value of the new issue.

History must describe Leopold as a great King. Under his guidance the country made rapid progress toward prosperity and a settled form of government. By his sincerity and real capacity for the business of government, Leopold I established a popularity that not even the French revolution of 1848 could shake, and when he died in 1865, the grief of his people was truly great.

He was succeeded by his son, Leopold II, whose portrait is shown on the one franc value. It was the new King's fate to be faced almost at once with a crisis of even greater magnitude than any that had gone before—the Franco-Prussian War of 1870. It was then that France and Germany signed the famous treaty, designated a "scrap of paper" in 1914 by Germany, under which both countries undertook to respect the neutrality of Belgium, Great Britain undertaking to defend the little country in the event of a violation of Belgian territory by one of these two countries.

Thus secured, Belgium went ahead. Agriculture—her greatest industry—flourished; commerce grew and prosperity once more became established. Progress was not confined to internal affairs, however, and Leopold II completed a great stroke of business when he secured the Congo basin in Africa for colonising. When the King died in December, 1909, he had established the country on a basis that was rapidly carrying it into a prominent position in the councils of Europe.



Leopold II was succeeded by his nephew, Albert, the present King of the Belgians, and the most democratic monarch that Europe has ever known. His tribulations have been greater than any borne by his predecessors. He has seen his country crushed under the heel of an invading army, and his territory laid waste. The spirit of his great uncle, Leopold I, lives on, however, for, while modern political administration ordains that Kings and Princes shall be but pieces in the game of statecraft, the King of the Belgians has worked as vigorously as any of his Ministers in the restoration of the devasted areas created by the great European War of 1914/1918.

The King's portrait appearing on the 1f.75 value is easily one of the best of him that has yet appeared on a Belgian stamp, but it would be interesting to learn why Belgium must always depict King Albert in military uniform. Undoubtedly he is a great soldier and during the War set a splendid example to his troops. But surely a country that has suffered so much from war as to be known to historians as the "Cockpit of Europe," would have much to gain by employing every possible avenue to instil the atmosphere of peace into all its dealings?

A very interesting companion stamp that may well be linked up for the purpose of this brief sketch of Belgian history, is the 10 fr. value of the Belgian 1915/22 general issue, which bears the portraits of each of the three Kings.

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"DIAMONDS"
MANY RARE STAMPS have been found by purchasers of **The "DIAMOND" Packet,** which is guaranteed to contain 1,000 Unsorted Stamps from Convents abroad, **1/3.** 2 packets **2/5**; 3 packets, **3/6**; 4 packets **4/6**; 5 packets **5/6.** All post free. (Abroad 3d. per pkt. extra).
O. NERUSH, Importer,
(Dept. E), 68, Turnpike Lane, Hornsey, N.8.

MECCANO WRITING PADS
These Writing Pads are just the thing to use when writing to your friends, for the special notepaper shows at once that you are a Meccano boy.
The pads are supplied in two sizes, each consisting of 50 printed sheets of tinted bank paper with cover. Prices—Large, 1/- each (post free); Small, 6d. each (post free), from Meccano Ltd., Old Swan, Liverpool.

New Meccano Models—(*Continued from page 717*)

end" (a Coupling 3) is free to turn on the crank pin between the Cranks, and is attached to the lower end of the connecting rod.

The valve gear is actuated by two Eccentrics that are mounted upon the crankshaft in such a manner that their throws are opposite, and each Eccentric is connected by a 4½" Strip to one end of an "expansion link" 4. The latter consists of two 2½" large radius Curved Strips bolted together at each end by a ¾" Bolt and three nuts. On one of these Strips slides a "die block" 5 and the other is connected pivotally to a crank arm 6 by a 2½" Strip. The die block is an Eye Piece, which is attached to the lower end of the valve spindle by a ½" Reversed Angle Bracket and an End Bearing. The crank 6 is mounted on the "weigh shaft" 6a, to one end of which is secured a 1½" Pulley carrying a "spider" (removed from a Swivel Bearing) in which works a Screwed Rod. The latter is rotated by turning the Wheel 7, so actuating the crank 6 and moving the expansion link in the die block.

The "thrust block" 8 consists of two Trunnions and one Flat Trunnion. The two former are bolted down to four Double Brackets 9, Washers spacing each Trunnion from the Double Brackets, whilst 1½" Strips keep the Trunnions apart. The lower portions of the Double Brackets are clamped between pairs of 2½" Strips bolted to the bed plate to keep the thrust block in position, whilst the Flat Trunnion is secured in place by a ½" × ½" Angle Bracket.

The circulating pump is represented by a Sleeve Piece 10 fitted with a ¾" Flanged Wheel, through which the pump plunger passes. The pump is retained in position by being pushed on to a Chimney Adaptor that is bolted to the base plate, and it is worked off the crosshead through a lever and links. The Boiler secured next to the pump represents the condenser.

The model marine engine contains the following parts:—

4 of No. 2; 4 of No. 2a; 1 of No. 3; 2 of No. 4; 10 of No. 5; 4 of No. 6a; 4 of No. 8a; 2 of No. 8b; 1 of No. 10; 7 of No. 11; 5 of No. 12; 1 of No. 14; 2 of No. 15; 4 of No. 16; 1 of No. 16a; 1 of No. 17; 2 of No. 18a; 1 of No. 20; 2 of No. 20a; 1 of No. 20b; 1 of No. 21; 1 of No. 23; 1 of No. 23a; 2 of No. 24; 86 of No. 37; 18 of No. 37a; 24 of No. 38; 1 of No. 48; 3 of No. 48a; 3 of No. 48b; 1 of No. 50a; 2 of No. 52; 3 of No. 53; 15 of No. 59; 2 of No. 62; 4 of No. 63; 1 of No. 80a; 2 of No. 90; 2 of No. 109; 2 of No. 111; 6 of No. 111c; 1 of No. 115; 1 of No. 116; 1 of No. 125; 4 of No. 126; 5 of No. 126a; 1 of No. 162; 1 of No. 163; 1 of No. 164; 1 of No. 165; 1 of No. 166.

This Space is set to ½ inch s.c. and costs 8/- per month. The sum is the 50th of £20, the price of a whole page advertisement. More than 70,000 copies of every issue are sold in various parts of the world. Your advertisement therefore reaches this exclusive public for approximately 1½d. per 1,000.

The Fascination of Kite Flying

Kite flying is one of those extraordinary pastimes that maintains its fascination throughout the years, the only change being that as we grow older we begin to use bigger and more elaborate kites. At one time the only commercial kites available to the average boy were so badly designed that the best of them were difficult to fly, while others simply would not fly at all. A great improvement has come about in this respect during the past few years. The productions of Roach's Kites Ltd., 16, Duke Street, Brighton, are so well designed that the makers are able to guarantee that each one will fly perfectly. The materials used in their construction are of the best quality, and the kites will stand a surprising amount of really rough usage. Printed instructions are provided with each kite, making mistakes impossible.

The tail kite is still popular, although it has lost in favour as the result of the development of box kites, of which there are now an astonishing variety. The most remarkable thing about a box kite is its lifting power, and the pull of a large one must be experienced to be believed. Many of these kites are made in bird-like shapes and look very effective when in flight.

An interesting illustrated catalogue will be sent post free on request by the above-mentioned firm to any reader who mentions the "*Meccano Magazine*."

Printing at Home

The advertisement pages of this issue of the "*Meccano Magazine*" contain an interesting announcement relating to the "Adana" Printing Machine. This is really quite a remarkable outfit, in that first class printed material can be turned out by the merest beginner—even if he has never seen a printing machine before.

The specimens of work which can be produced are really astonishing, considering the size of the apparatus, which is simplicity itself to handle.

Many boys who already possess an "Adana" Machine are now enthusiastic amateur printers, who produce anything from an ordinary small label or visiting card up to an illustrated school magazine.

Our readers are invited to send for full particulars, which will be sent without obligation if the "*Meccano Magazine*" is mentioned when writing, to the Inventor, Mr. D. A. Adana, at 17, Church Street, Twickenham, Middx.

Stamp Gossip

Architectural Congress Stamps

In connection with the fourth Pan-American Architectural Congress recently held in Brazil, a short series of three stamps, 100, 200 and 300 reis values, has been issued by Brazil. Our illustration of the 200 reis shows how excellent were the designs, in this instance the representation being a silhouette view of the statue of Liberty with some of New York's great sky-scrapers in the background. The remaining values bore somewhat similar designs, presented in equally effective manner.

Rembrandt Commemorative

Belgium is not alone in its recent use of the portrait of a great painter for stamp design purposes. Only a month or two ago, in February, to be precise, Holland issued a special charity series of stamps bearing a portrait of Rembrandt, the great Dutch artist. The stamps were sold at a premium to create a fund to assist the Rembrandt Society to raise funds for the purchase of some of the "Old Master's" work for preservation in Dutch museums and art collections.

The issue comprised 3 stamps, 5c., 6c., and 12c., each carrying a premium of 5c., and the design in each case was as shown in our illustration, depicting Rembrandt and "De Stalmeesters."

with the decision that the new British airships shall not carry mails on their first big flights. The flights of the Graf Zeppelin will be perpetuated for all time in the albums and catalogues devoted to aero-philately, while those of our British airships will be relegated to oblivion. Modesty is all very well, but can Britain afford to be modest in these days of world-wide publicity?—*Gibbons' Stamp Monthly.*

We take this opportunity of making acknowledgment to Stanley Gibbons Ltd., for their courtesy in loaning the stamps from which the illustrations used with our Stamp notes have been prepared.

A British Air Mail Stamp

The Official View

We are indebted to Mr. George P. Cutress for a sight of a reply received from Imperial Airways Ltd. to a suggestion that it was desirable that a special stamp should be issued in this country for Air Mail use. The reply states:—"This subject has been very fully considered by this Company in conjunction with the Post Office and we have come to the conclusion that the issue of a special stamp would be most undesirable. The whole object of Air Mail is simplicity, and if it is necessary for a person desiring to send an Air Mail letter to purchase a special stamp at the Post Office, then the matter immediately becomes complicated, and an Air Mail might not be used to the extent desired.

In general, we cannot see any particular use for a special Air Mail stamp except to cater for the wishes of a few philatelists,

and although we are of course anxious at all times to assist, the wider view has to be taken, and we very much regret therefore that we cannot concur with your suggestion that special stamps should be printed."

We think the official view is based on the assumption that the only interest of philatelists in the matter is the desire to have a new stamp. Frankly we believe that philatelists would be very glad to have far fewer new stamps, but in this case they realise how valuable such a stamp would be as propaganda for British air mails. They see not hundreds, but thousands, of stamp collectors aware from their albums that many countries have Air Mail services, but there is nothing to tell them of the wonderful work of the British services. For the general public, too, nothing would be a more potent reminder of the existence of the Air Mails than such a special stamp. Blue pillar-boxes, and Air Mail labels in the stamp booklets, are steps in the right direction, but we think that both the Post Office and the Company are taking, not the wider, but the narrower view, in deciding against a British air stamp.

The same outlook is shown in connection

(*Continued at foot of previous column*)

Finnish Red Cross Issue

Charity issues usually can be depended upon to produce some striking designs, but few attain this level with such striking simplicity as Finland's recent Red Cross issue, in which three most simple yet amazingly effective designs were introduced. We illustrate the 2 mark + 20 penni value, that showing an "end on" view of an ancient Viking ship with the red cross of Geneva emblazoned on its fully extended sail. The lettering and design are in white upon a dark blue background.

Equally unpretentious, the 1m. + 10p. shows the Red Cross flag on a lance, while on the 1½m. + 15p. the flag is draped over a sword blade.

Uruguayan Centenary

The probability of a commemorative stamp issue to celebrate the centenary of Uruguayan independence was forecast in our Stamp Gossip notes last month, and we are now able to illustrate two of the actual designs employed in the long set that has been issued.

The set contains 16 values, ranging from 5 milesimos to 5 pesos. The designs are as follows:—5m., Rio Negro Bridge,

as illustrated; 1 and 2c. Allegorica Groups; 3c., Artigas Monument and Buildings; 5c., Head of Liberty and Uruguayan Flag; 8c., Allegorical figure-bearing Torch; 10c., Artigas, from a picture by Blanes; 15c., a Seascape; 20c., a view of the Harbour of Monte-Video in 1830, also illustrated here; 24c., the Head of Liberty and the Arms of Uruguay; 50c., Monte Video Harbour 1930; 1, 2, 3, 4 and 5 pesos, the Artigas Monument.

With the exception of the 2, 3 and 8 centisimos and the 1 to 5 pesos values, which are vertical, all the stamps are horizontal in shape.

Meccano & Hornby Train Supplies

All the dealers whose advertisements appear on the following two pages carry full stocks of Meccano Outfits, Accessory Outfits, and Meccano parts, Hornby Trains and Hornby Train Accessories all the year round. The names are arranged in alphabetical order of town.

JOHN N. PIPER,
118, Union Street,
Tel. 2797 ABERDEEN.

HARRY BROWN,
1, Moss Lane,
ALTRINCHAM.

BENNETT WATTS,
10, Silver Street,
Tel. 229 AYLESBURY.

Belfast Co-operative Society Ltd.,
20, York Street,
Tel. 6621 BELFAST.

J. BELL,
10, Lower Garfield St.,
Royal Avenue, BELFAST.

RIDDELS LTD.,
Donegall Place & Fountain St.,
Tel. 4171 BELFAST.

SPORTS DEPOT,
57, Victoria Street,
Tel. 4554 (Nr. Albert Memorial) BELFAST.

MERCER'S DOLLS' HOSPITAL,
68, Darwen Street,
BLACKBURN.

BATESON'S SPORTS DEPOT,
Abingdon Street,
Tel. 461 BLACKPOOL.

SELLENS BAZAAR,
54, Waterloo Road,
BLACKPOOL, S.S.

BURGESS' BAZAAR,
Opposite The Pier,
BOGNOR REGIS.

RUSHWORTHS LIMITED,
Kirkgate,
BRADFORD.

CHARLES E. READ,
64, High Street,
BRIERLEY HILL, Staffs.

JOHN TAYLOR,
28, Preston Street,
Tel. : Brighton 1357 BRIGHTON.

S. H. ARTHUR,
15 & 16, Narrow Wine Street,
Tel. 511 BRISTOL.

C. E. CONEYBEARE,
470-2, Stapleton Road,
Eastville, BRISTOL.

M. W. DUNSCOMBE LTD.,
5 & 7, St. Augustine's Parade,
BRISTOL.

GYLES BROS. LTD.,
Tel. 2888 24, Bridge Street, BRISTOL.
188, Whiteladies Road, Clifton, BRISTOL.
Tel. 143

SALANSON LTD.,
20, High Street, BRISTOL.
119, Queen Street, CARDIFF.

HAROLD HUNT,
38, Spring Gardens,
Tel. 202 BUXTON.

PANTOYS LTD.,
The Promenade,
Tel. 3561 CHELTENHAM SPA.

S. DAVIS,
50, Broad Street, CHESHAM.
3, Station Parade, Croxley Green.

EYRE & SONS LTD.,
Ironmongery Dept., Arcade,
Tel. 2181 CHESTERFIELD.

R. H. JEPSON, 1, Cross Cheaping,
Tel. 4968 COVENTRY.
1, Queen's Road, NUNEATON.

"LE BON" STORES,
97, Liverpool Road,
Tel. : Crosby 1533 CROSBY.

E. A. ANELAY,
Parkgate,
Tel. 2925 DARLINGTON.

HENRY WHALLEY,
195, Duckworth Street,
7, Bolton Road, DARWEN.

RANBY'S LTD.,
Victoria St. & Green Lane,
Tel. 298 DERBY.

SHEARD, BINNINGTON & CO.,
44, High Street,
Tel. 85 DONCASTER.

SWADDLING,
60, South Street,
Tel. 295 DORKING.

JAMES L. DIXON,
14, Suffolk Street,
Tel. : Dublin 21826 (off Grafton St.), DUBLIN.

DIXON'S,
41, High Street,
Tel. 5810 DUNDEE.

MARTINS',
232, Hilltown,
DUNDEE.

SMITH BROTHERS,
"The Globe," 3-15, Murraygate,
DUNDEE.

ALDERTON'S,
8, Bank Parade,
Tel. 0303 EDGWARE.

A. G. ANDERSON,
105, Princes Street,
EDINBURGH.

WRIGHT'S DOLL'S HOSPITAL,
14, High Street,
ERDINGTON.

Devon & Somerset Stores Ltd.,
Toy & Sports Dealers,
Tel. 2638
Telegrams : Stores, Exeter EXETER.

BOW'S EMPORIUM Ltd.,
High Street,
Tel. : Bell 885 GLASGOW, C.1.

LUMLEY'S,
Lumley House, Sauchiehall Street,
Tel. : Douglas 2701 GLASGOW.

R. WYLIE HILL & CO. LTD.,
20, Buchanan St. & Argyll Arcade,
GLASGOW, C.1.

G. WATSON,
Guildford Doll's Hospital,
Swan Lane, GUILDFORD.

WELTON'S TOY STORES,
5, Pond Street,
HAMPSTEAD, N.W.3.

H. POULTON, Toyland,
75 & 77, High Street,
HOUNSLOW, Middlesex.

YE OLDE TOY SHOPPE,
Chariot Street,
Tel. : Central 1031 HULL.

WALKER'S EMPORIUM,
25-29, Inglis Street,
INVERNESS.

PEARSON & DENHAM (PHOTO) LTD., 6, Bond Street, LEEDS.

A. WRIGHT, The Garage, 200/2, Dewsbury Road, Tel. 22719 LEEDS.

Leicester Co-operative Society Ltd., High Street, LEICESTER.

ROBOTHAM'S LIMITED, "Baby's Kingdom," Tel. 4809 Belvoir St., LEICESTER.

J. T. WEIGHTMAN, 198, Charnwood Street, Tel. 58804 LEICESTER.

FREDERICK BECK, 22, 24 & 26, Camden Passage, Tel. : Clerkenwell 8403 LONDON, N.1.

A. & B. BLACKMAN & SONS, 11a-17, Fortess Road, Kentish Town, Tel. Mount View 4310 LONDON, N.W.5.

Bon Marché Ltd., Brixton, LONDON, S.W.9.

W. HUMPHRYS & SON, 269/271/273 & 275, Rye Lane, Estab. in 1840 PECKHAM, S.E.15.

LAFFEATY, 308, King's Road, Chelsea, Tel. : Kensington 2705 LONDON, S.W.3.

LEDWITH BROS., 42 & 44, Walworth Road, Nr. ELEPHANT AND CASTLE LONDON, S.E.17.

Mr. A. LOGAN, 47, New Road, Woolwich, LONDON, S.E.18.

PERCIVAL & CO., 140, High Street, Tel. Wstw. 0120 WALTHAMSTOW, E.17.

AUGUSTUS SMITH, 8, Sunderland Road, Forest Hill, LONDON, S.E.23.

OGDEN SMITHS LONDON DEPOTS, Clapham Junction, Sutton, Bromley, Croydon, Twickenham, Brixton and Sydenham. Chief Office, Clapham Junction.

F. R. POTTER & SON, 43, Market Place, LOUGHBOROUGH.

H. G. PARTRIDGE & CO., 10, Chapel Street, Tel. 234 LUTON.

A. E. WILKINSON & SON, 57, High Street, Tel. 831 MAIDSTONE.

HENRY'S Toy & Game Stores, 22, King Street, Tel. 3004 Central MANCHESTER.

A. INMAN, MANCHESTER. 105, Lapwing Lane, Didsbury. Tel. 1518. 179, Dickenson Rd., Rusholme. Tel. 2241.

JOHN NESBITT LTD., 42, Market Street, City 2284 MANCHESTER.

H. WILES LTD., 124, Market Street, MANCHESTER.

JACKSON'S CYCLE STORES, 158, Parliament Road, MIDDLESBROUGH.

R. SCUPHAM & SONS LTD., 35, Linthorpe Road, MIDDLESBROUGH.

W. MARK & CO. LTD., 27, The Drapery, Tel. 461 NORTHAMPTON.

BEECROFT & SONS, 16, Pelham Street, Tel. 41434 NOTTINGHAM.

E. O. ELLIS, 195 & 197, Berridge Road, NOTTINGHAM.

J. R. NORRIS, Photographic Dealer, 9, Pelham Street, NOTTINGHAM.

PEARSON & PEARSON, 12, Angel Row, NOTTINGHAM.

REDMAYNE & TODD LTD., Carrington Street, Tel. 41604 NOTTINGHAM.

THE ATHLETIC STORES, Opposite Town Hall, Tel. 1238 OLDHAM.

E. DE LA MARE, 9/13, George Street, Tel. 3456 OXFORD.

JOE ANDERSON, 9-15, St. John Street, Tel. 109 PERTH.

LAWSONS LTD., 13, Frankfort Street, Tel. 398 PLYMOUTH.

D. J. WARREN, 6, Hyde Park Place, Mutley, Tel. 1482 PLYMOUTH.

THOMAS JARVIS LTD., REDRUTH. Branches at Cambourne, Penzance, Truro, Newquay & Falmouth.

F. SHEPPARD, 58, Kew Road, Tel. 1970 RICHMOND, SURREY.

GERALD MORRIS, 24 & 26, High Street, ROCHESTER.

JAMES GRAHAM, 9, Montague Street, ROTHESAY.

A. V. WORDEN, "Toyland," Park Road, ST. ANNES ON SEA.

SHEFFIELD PHOTO CO. LTD., 6, Norfolk Row (Fargate), Tel. 23891 SHEFFIELD.

WILSON, GUMPERT & CO. LTD., 57, Fargate, Tel. 20489 SHEFFIELD.

OSBORN & CO. (So'ton) Ltd., 9, High Street, Tel. 3587 SOUTHAMPTON.

WRIGHT & CO., 365 & 367, High Street, Tel. : Maryland, 2942 STRATFORD, E.15.

SAXON'S (SUNDERLAND) LTD., 29, Holmside, Tel. 1535 SUNDERLAND.

DAN MORGAN, The Meccano Centre, 218, Oxford St., Tel. 2346 SWANSEA.

GOLDSMITH'S, 18, High Street, Tel. 392 SWINDON.

E. M. COLLINS, 12, Lower Castle Street, TRALEE.

W. JACKSON, 56 & 58, High Road, WOODFORD GREEN.

MECCANO WRITING PADS

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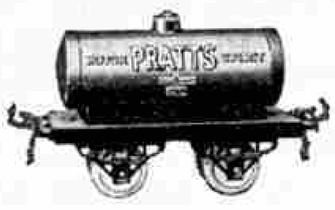
HORNBY SERIES

HORNBY ROLLING STOCK

GAUGE 0

Hornby Rolling Stock includes almost every type in use on the big railways, and a selection of the splendid range available is illustrated on this page. The various items are modelled on realistic lines and are beautifully enamelled, mostly in the correct colours of the L.N.E., L.M.S., G.W. or Southern Railways.

Ask your dealer to show you the full range of Hornby Rolling Stock.

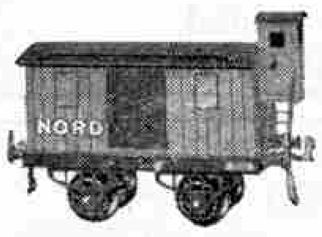


PETROL TANK WAGON "PRATTS"
Finished in green.
Price **2/6**

PETROL TANK WAGON "B.P."
Finished in yellow.
Price **2/6**

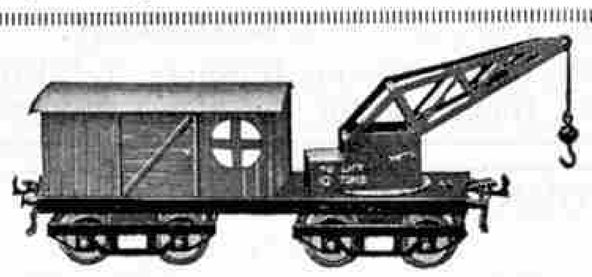
PETROL TANK WAGON "SHELL"
Finished in red.
Price **2/6**

PETROL TANK WAGON "REDLINE"
Finished in blue and red.
Price **2/6**



BRAKE VAN (French Type)
Lettered "Nord." Beautifully finished in colours. Opening doors. Price **4/-**

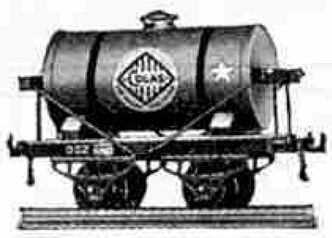
***HORNBY No. 1 PASSENGER COACH**
Realistic in design and fitted each side with opening doors. Price **2/6**



***BREAKDOWN VAN AND CRANE**
Beautifully coloured in brown and blue, with opening doors. Suitable for 2-ft. radius rails only. Price **6/3**

GUARD'S VAN
Realistic design, fitted each side with opening doors. Obtainable in L.N.E.R., L.M.S., G.W. or S.R. colours. Price **3/-**

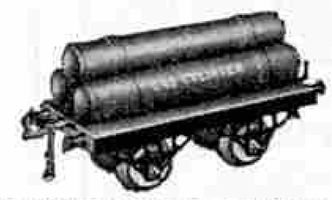
WAGON (French Type)
Lettered "Nord." Highly finished in colours. Price **3/3**



BITUMEN TANK WAGON "COLAS"
Finished in blue.
Price **5/3**

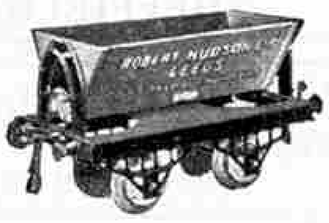
ROTARY TIPPING WAGON
Finished in orange. Lettered "Meccano." Price **3/-**

RIVIERA "BLUE" TRAIN COACH
"Dining" or "Sleeping."
This is a beautiful model, substantially built and well finished. Suitable for 2-ft. radius rails only.
Price **14/-**

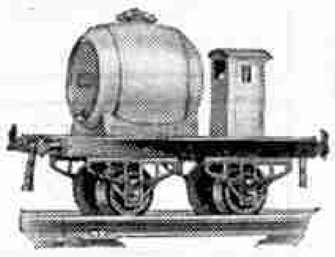


GAS CYLINDER WAGON
Finished in red, lettered gold. Price **2/6**

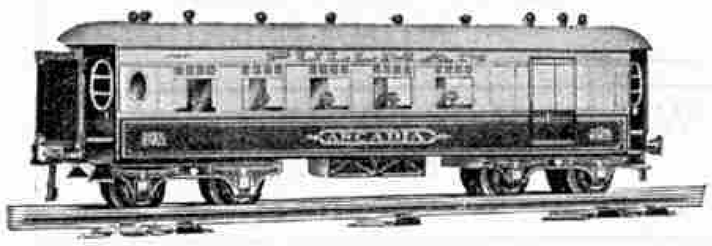
MILK TANK WAGON "UNITED DAIRIES"
A very realistic model, finished in blue and white. Price **6/-**



SIDE TIPPING WAGON
Excellent design and finish. Lettered "Robert Hudson Ltd." Price **2/6**

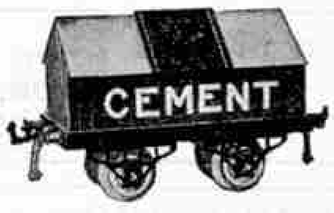


WINE WAGON, SINGLE BARREL
An interesting model of the single-barrel type of wine wagon used in France. Finished in red and green. Price **4/-**



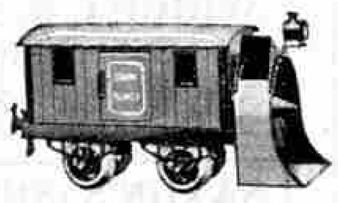
†HORNBY No. 2 SPECIAL PULLMAN COACH COMPOSITE
As supplied with No. 2 Special and No. 3 Pullman Train Sets. One part is designed for passenger accommodation and the other for conveyance of luggage. Suitable for 2-ft. radius rails only.
Price **16/-**

COVERED WAGON (French Type)
This wagon is fitted with frame and sheet. French type, lettered "Nord." Price **3/-**

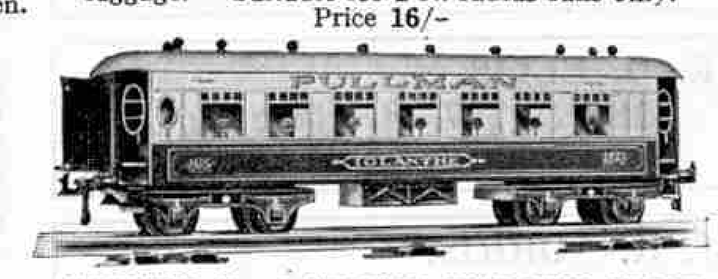


CEMENT WAGON
Finished in red.
Price **3/-**

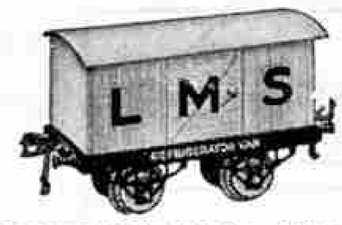
TIMBER WAGON No. 1
Beautifully enamelled in green and red. Price **1/9**



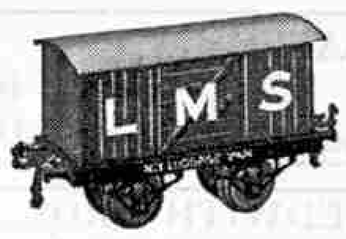
SNOW PLOUGH
With revolving plough driven from front axle.
Price **5/6**



†HORNBY No. 2 SPECIAL PULLMAN COACH
As supplied with No. 2 Special and No. 3 Pullman Train Sets. This splendid coach is perfect in detail and finish. Suitable for 2-ft. radius rails only. Price **15/-**

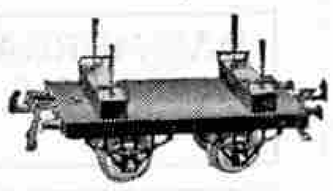


***REFRIGERATOR VAN**
Beautifully enamelled. Fitted with opening doors.
Price **3/9**



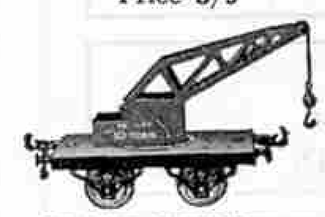
***LUGGAGE VAN No. 1**
With opening doors.
Price **3/6**

***GUNPOWDER VAN**
Finished in red. With opening doors. Price **3/6**

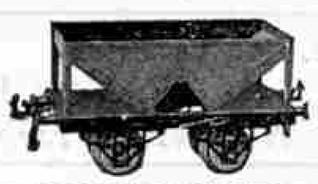


LUMBER WAGON No. 1
Fitted with bolsters and stanchions for log transport. Price **2/-**

TROLLEY WAGON
Finished in brown and blue. Suitable for 2-ft. radius rails only. Price **4/6**

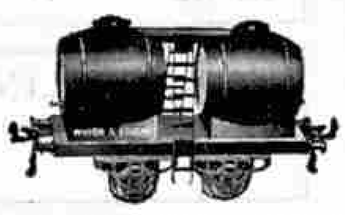


CRANE TRUCK
Finished in brown and blue. Price **3/6**



***HOPPER WAGON**
Mechanically unloaded. Finished in green. Price **3/6**

MILK TRAFFIC VAN
Fitted with sliding doors. Complete with milk cans.
Price **3/6**



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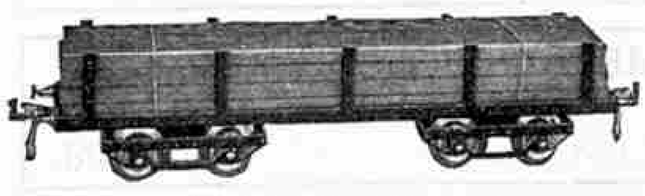
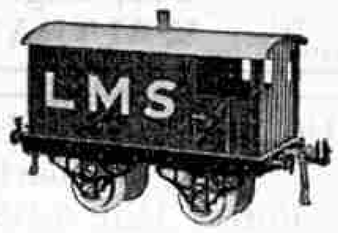
An attractive model, artistically enamelled in red and green. Price **5/-**

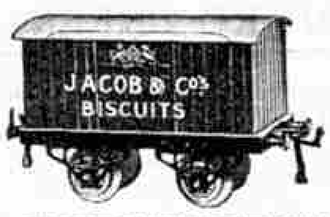


TIMBER WAGON No. 2
Beautifully enamelled in green and red. Suitable for 2-ft. radius rails only. Price **3/6**

BRAKE VAN
Finished in brown. With opening doors. Obtainable in N.E. or S.R. lettering. Price **3/6**



BRAKE VAN
Finished in Grey. Opening doors. Obtainable with L.M.S. or G.W. lettering. Price **3/6**



JACOB'S BISCUIT VAN
Finished in crimson lake. With opening doors.
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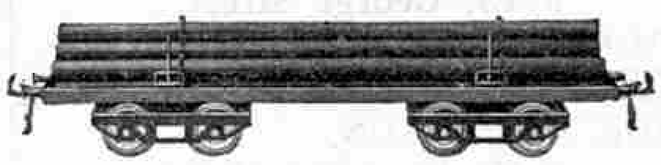
CARR'S BISCUIT VAN
Finished in blue. With opening doors. Price **3/6**



LUMBER WAGON No. 2
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Price **4/-**

**In L.M.S., L.N.E.R., G.W., or S.R. lettering.*
†Previously known as No. 2/3 Pullman Coaches.

CRAWFORD'S BISCUIT VAN
Finished in red. Opening doors. Price **3/6**

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Beautifully finished in blue. With opening doors.
Price **3/6**

Manufactured by MECCANO LIMITED, BINNS ROAD, OLD SWAN, LIVERPOOL

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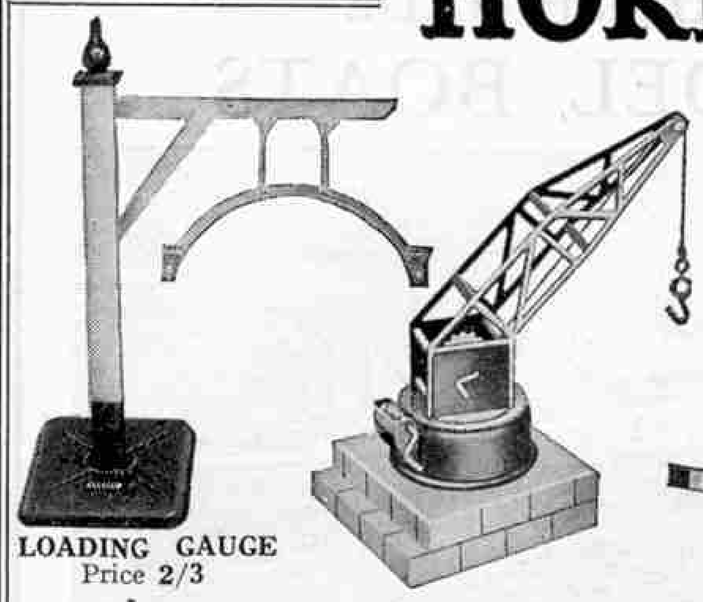
HORNBY SERIES

There is a splendid range of Railway Accessories in the Hornby Series, built in perfect proportion and beautifully finished. With these realistic Accessories the most elaborate model railway system may be constructed and operated in exactly the same manner as a real railway.

A selection of Hornby Accessories is illustrated below. Your dealer will be pleased to show you the full range.



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Price **2/3**

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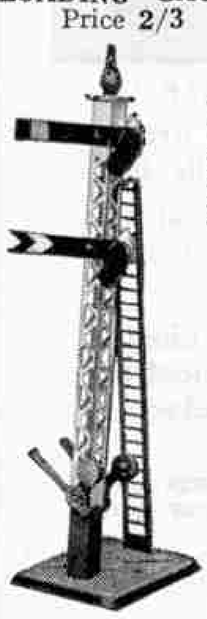
This is a useful accessory. The Crane revolves on its base and is fitted with a crank and ratchet mechanism for controlling the load. Price **4/9**



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(As illustrated.)
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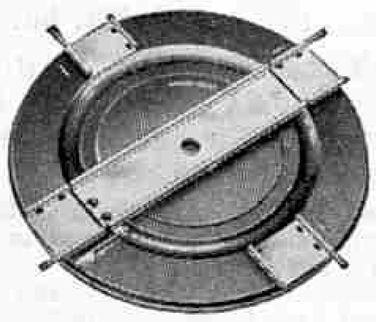

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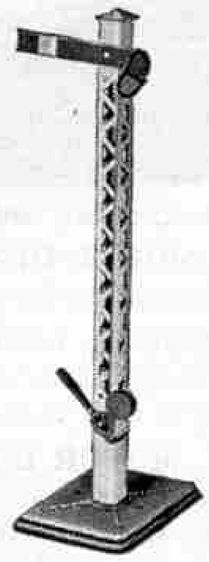

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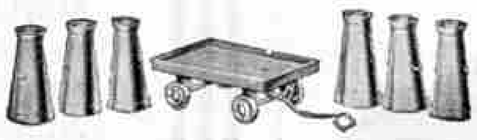

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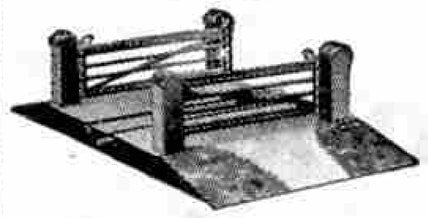

LEVEL CROSSING No. 1
This model is realistic in appearance and beautifully enamelled in colours. It is suitable for a single track only and has gauge 0 rails in position.
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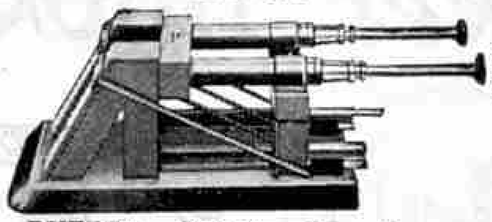

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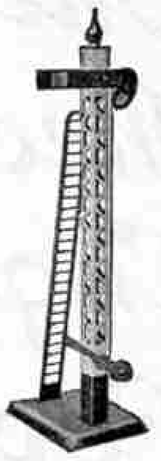
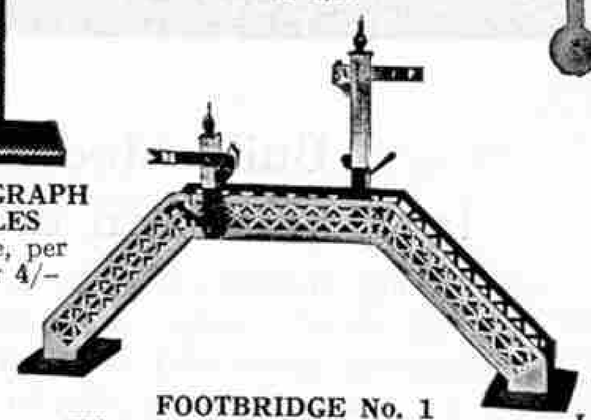
Price **5/6**

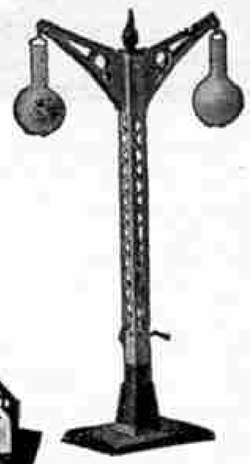


SIGNAL No. 2
Price **2/6** each. "Home" or "Distant."



FOOTBRIDGE No. 1
(Without signals) ... Price **4/-**

FOOTBRIDGE No. 2
(As illustrated), complete with detachable signals. Price **7/6**
Signals only, per pair **3/9**



LAMP STANDARD No. 2 (DOUBLE)
Electric flash-lamp bulbs may be fitted into the globes.
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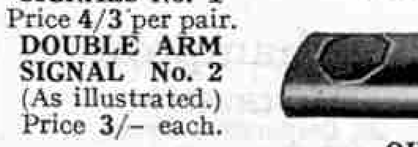

OIL CAN No. 1
This miniature Oil Can will give every satisfaction.
Price **6d.**

TARPAULIN SHEETS
Strongly made. Lettered L.M.S., N.E., G.W. or S.R. The above illustration shows one of the Tarpaulin Sheets fitted to a Hornby Wagon.
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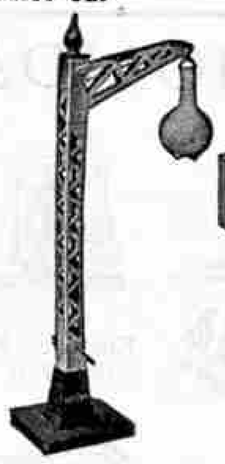
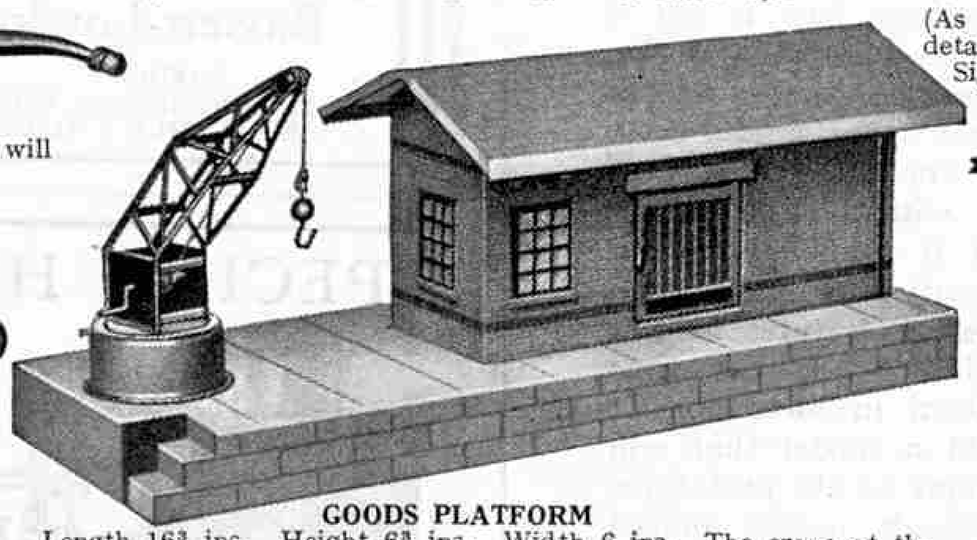


LAMP STANDARD No. 1 (SINGLE)
An electric flash-lamp bulb may be fitted into the globe. Price **3/6**



GOODS PLATFORM
Length 16¾ ins. Height 6¾ ins. Width 6 ins. The crane at the end of the platform revolves on its base. It is enamelled in colours and is fitted with a crank and ratchet mechanism for controlling the load ... ... Price **12/6**

VIADUCT. Price **7/-**. **Centre Section only.** Price **4/9**
ELECTRICAL VIADUCT. Price **8/-**
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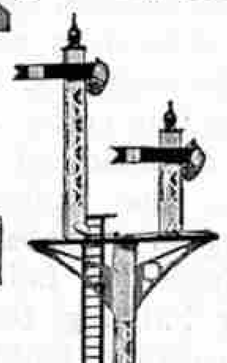
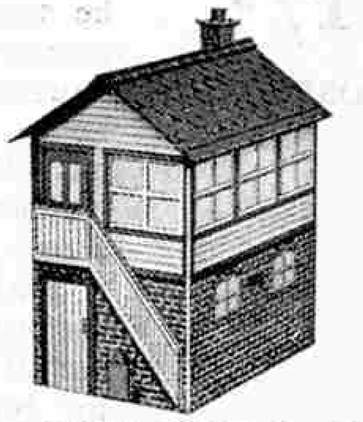
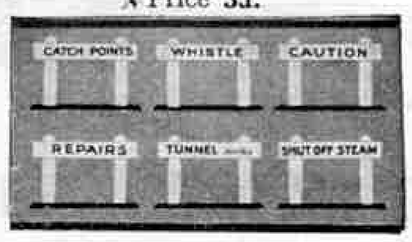


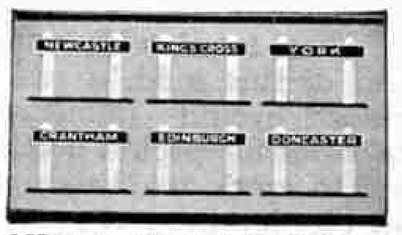
JUNCTION SIGNAL
"Home" or "Distant." Signal arms operated by levers at base. Very realistic model, standing 14 ins. in height.
Price **6/-**



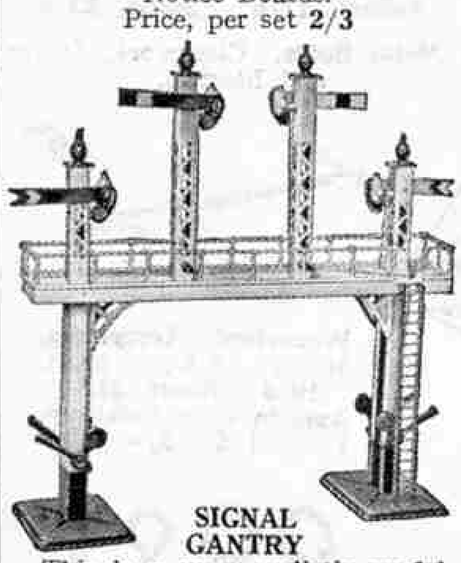
SIGNAL CABIN No. 1
Dimensions: Height 6 ins. Width 4½ ins. Length 6 ins. Finished in colours ... Price **2/9**



RAILWAY ACCESSORIES No. 8
Notice Boards.
Price, per set **2/3**

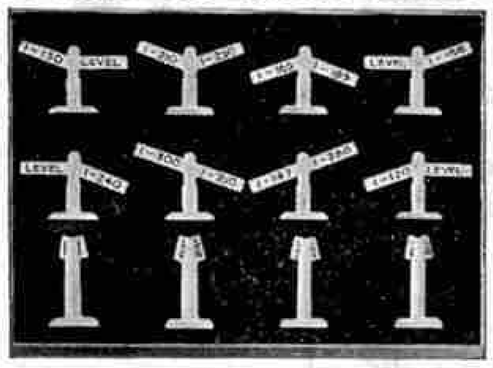


RAILWAY ACCESSORIES No. 9
Station Name Boards.
Price, per set **2/6**



SIGNAL GANTRY
This is a very realistic model, the signal arms of which are operated by levers at the base of the standards. Attractively finished in colours. Price **10/-**

RAILWAY ACCESSORIES No. 7
Watchman's Hut, Brazier, Shovel and Poker ... Price **1/6**



RAILWAY ACCESSORIES No. 5
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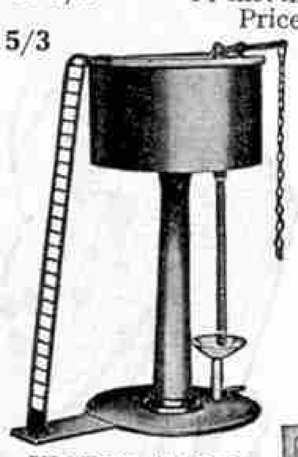

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Brightly coloured. Fitted with flexible tube and valve lever.
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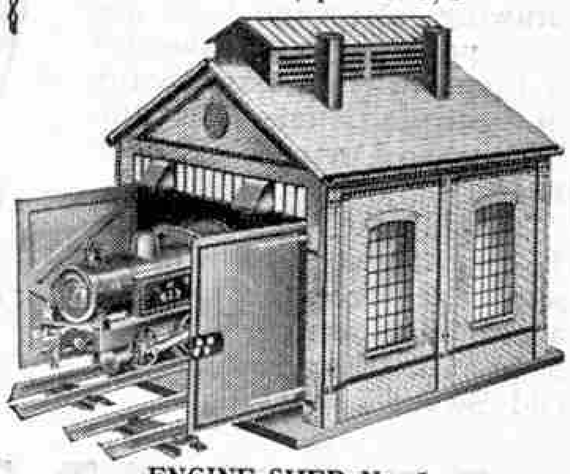
RAILWAY STATION No. 2. Excellent model, beautifully designed and finished. Constructed in three sections, which are detachable, Dimensions: Length 2 ft. 9 ins., breadth 6 ins., height 7 ins. ... ... Price **12/6**



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This Shed is beautifully finished in realistic colours. It will accommodate Locomotives and Tenders of the M series, and Locomotives of No. 0 and No. 1 types ... ... Price **15/-**

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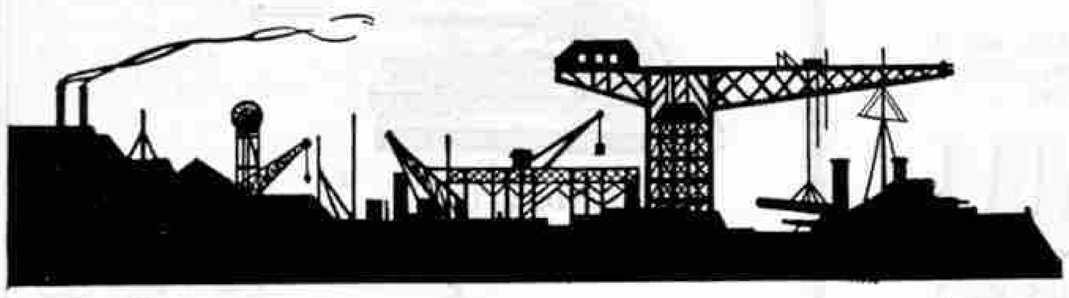

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Supposing a Meccano boy is on a tour of inspection of some interesting docks, and that a cleverly designed crane catches his eye. If he does not carry a note book he tries to memorise the most important features of this crane, with a view to constructing a model of it upon his return home. In the majority of cases the memorising of engineering features in this manner leads to failure when the time comes for building them in Meccano. It is fairly easy to build a model that will perform similar functions to its prototype, but it is a very difficult matter indeed to reproduce from memory individual mechanical details.

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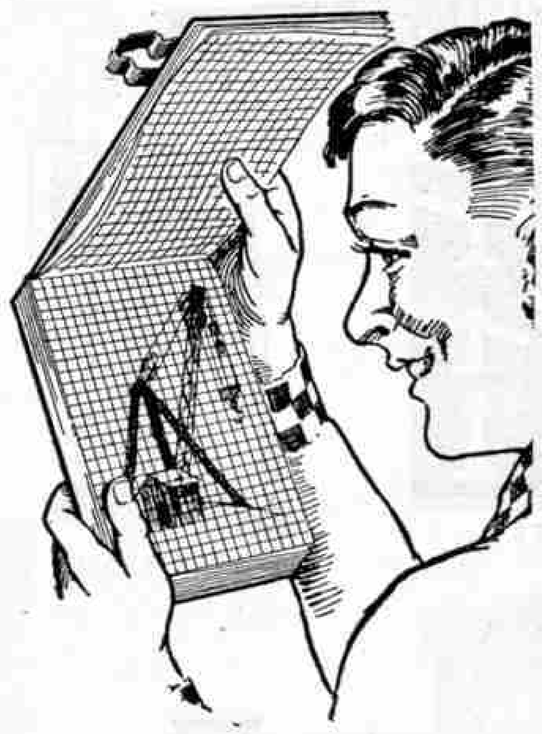

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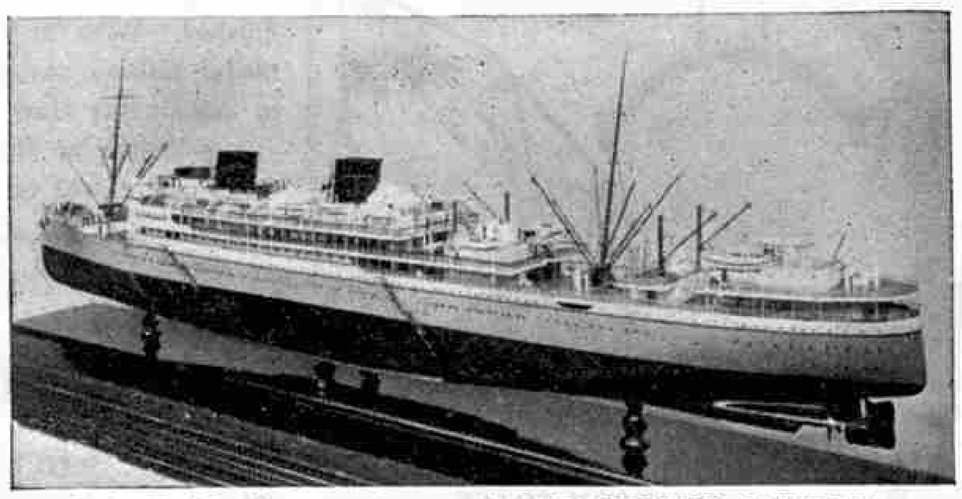

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SCALE MODEL DESTROYER. "No. D.36," fitted with efficient modern steam plant. Price **£10 10s. 0d.**

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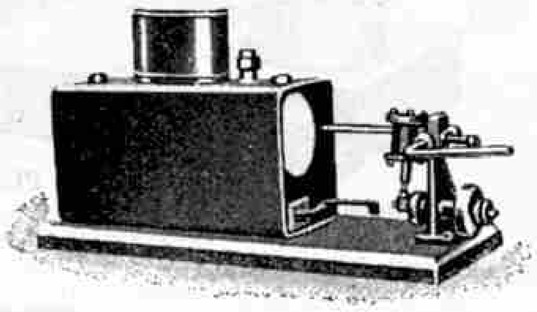
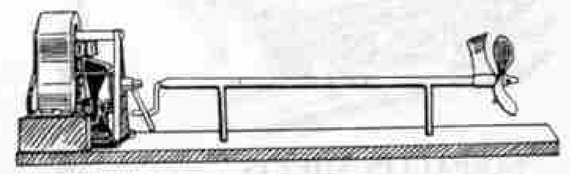
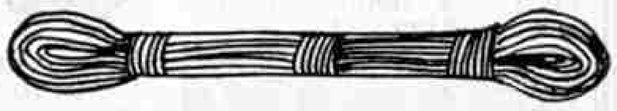


S.T. Engine & Boiler. Engine Parts, 5/–; Finished Boiler, 8/–; Finished Engine and Boiler, 13/–. Postage Free.



Electric Motor. Reversible, Self-starting. Price **7/6.** Propeller and Shaft to fit, **1/6**



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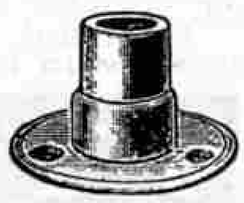

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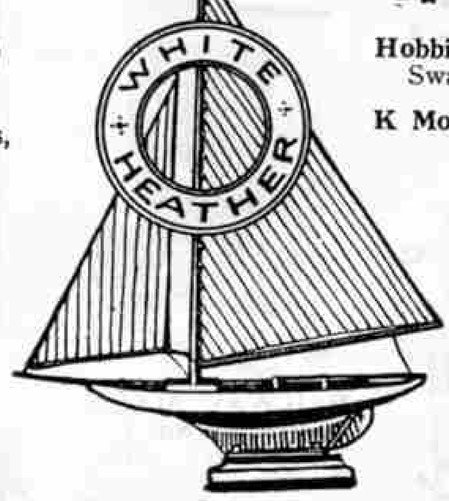

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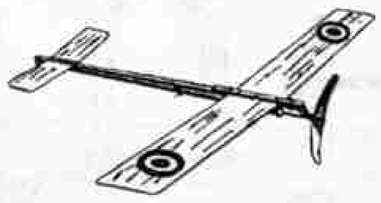

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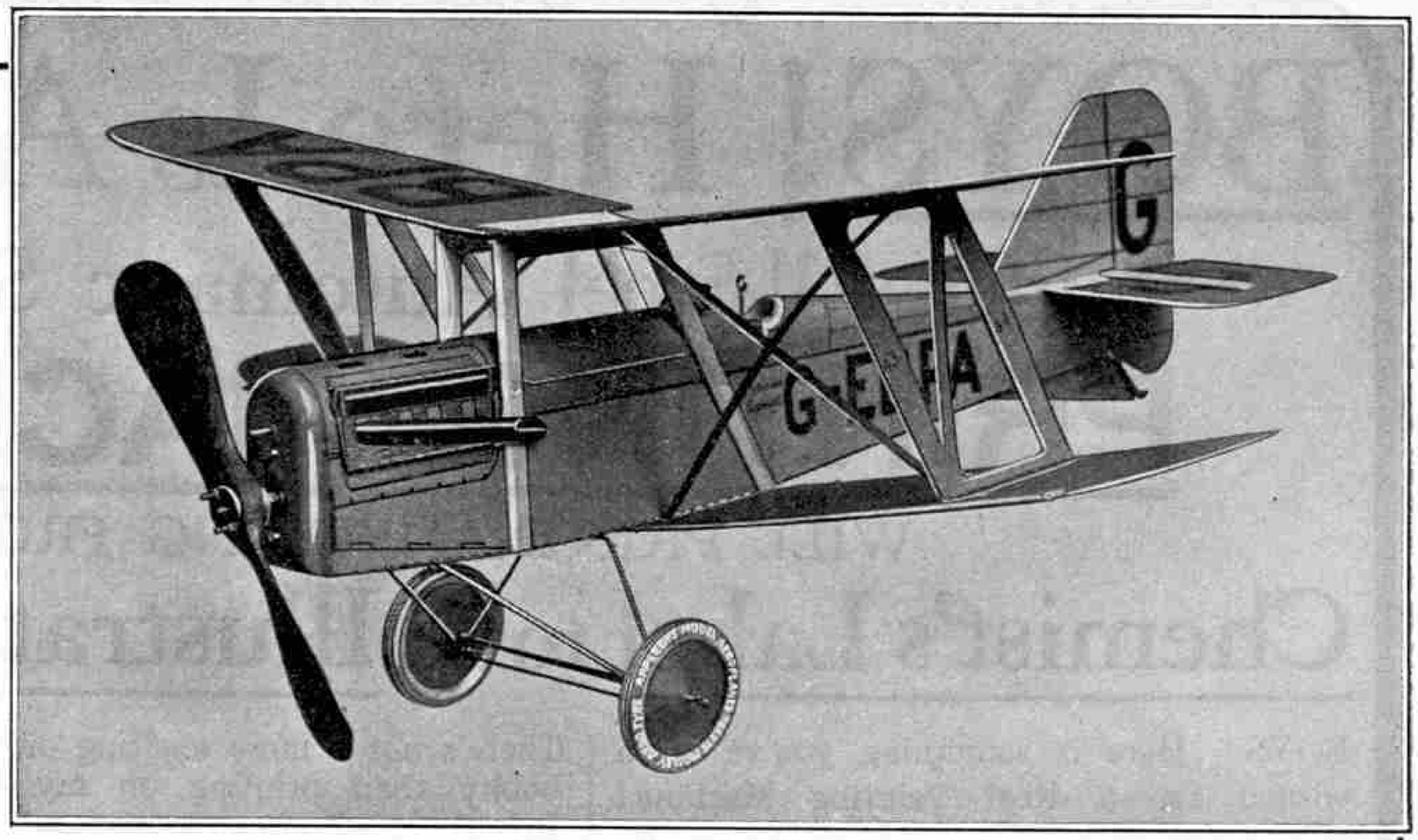

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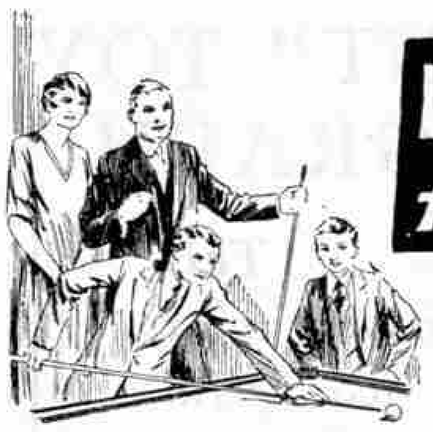

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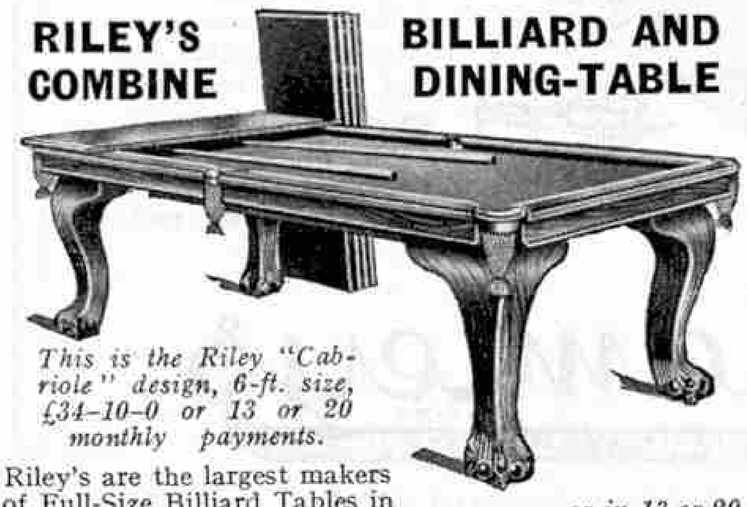

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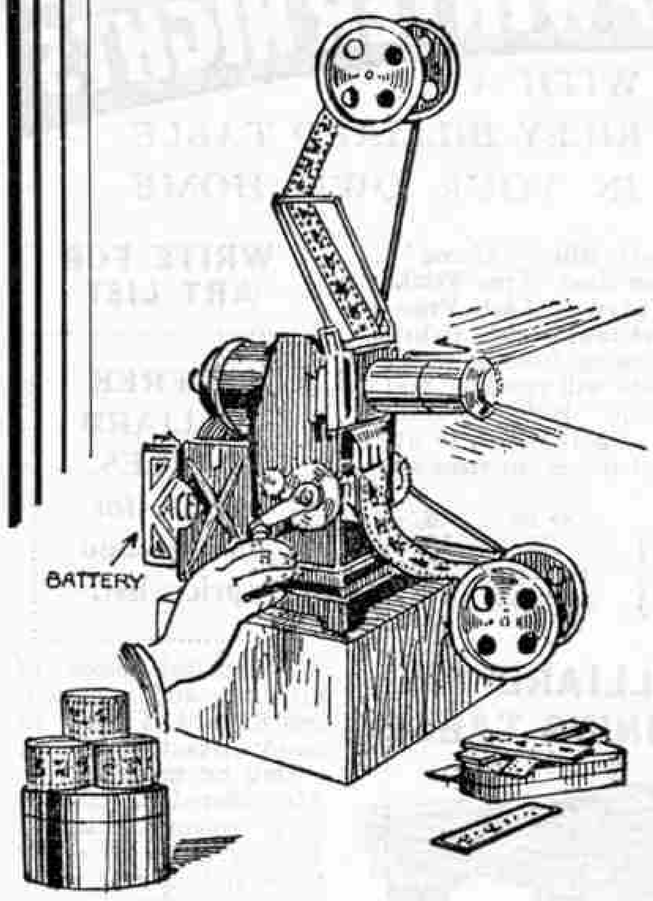

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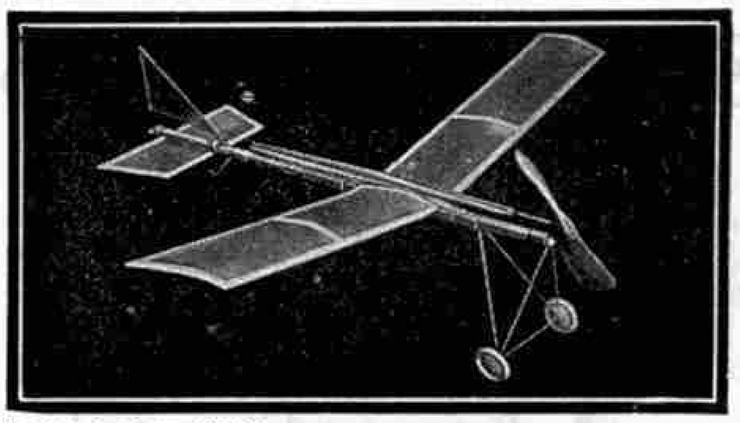

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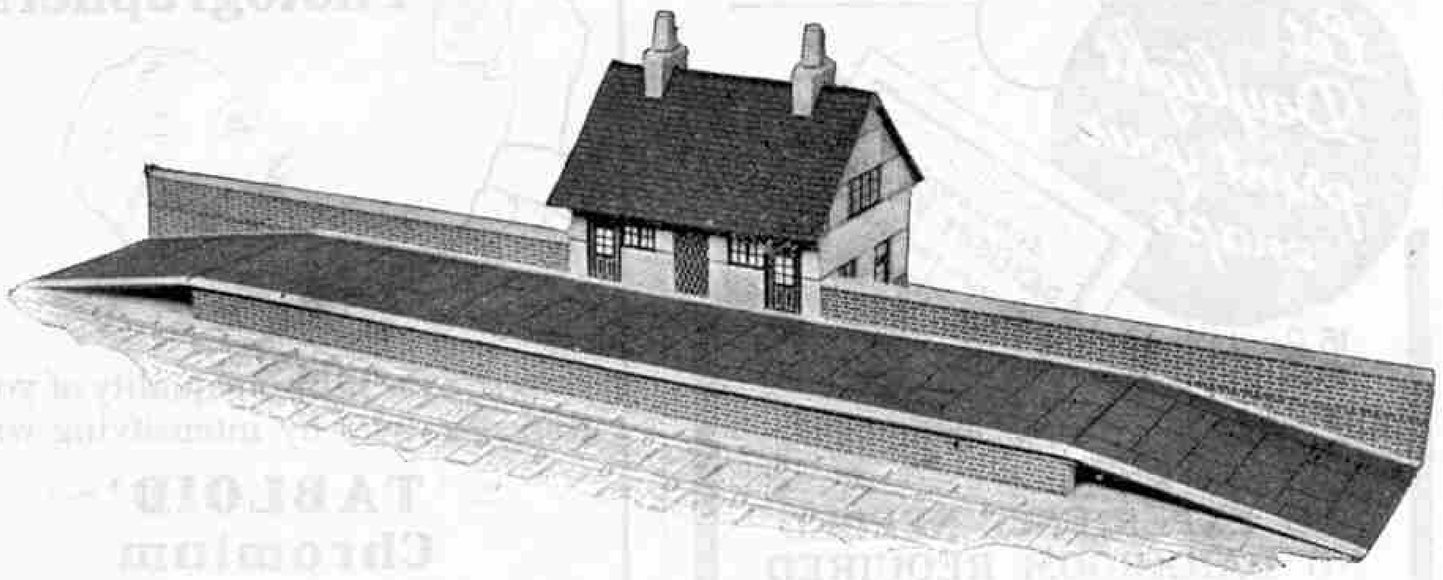

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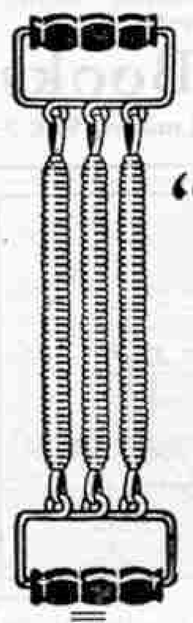

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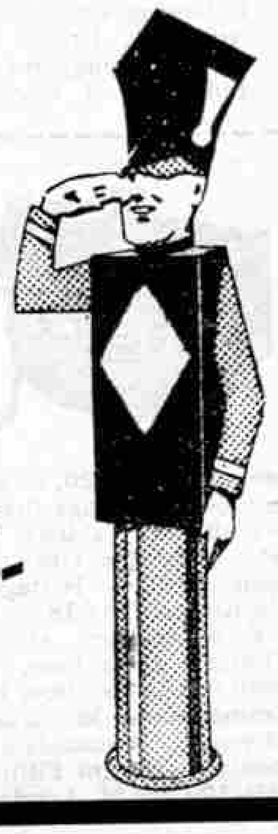

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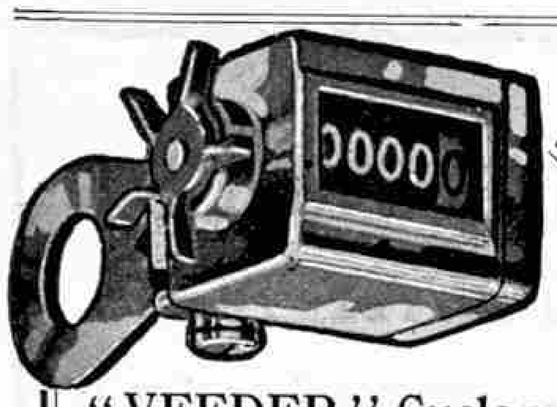

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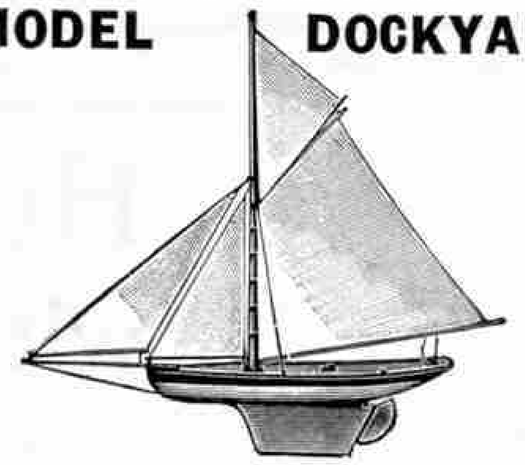

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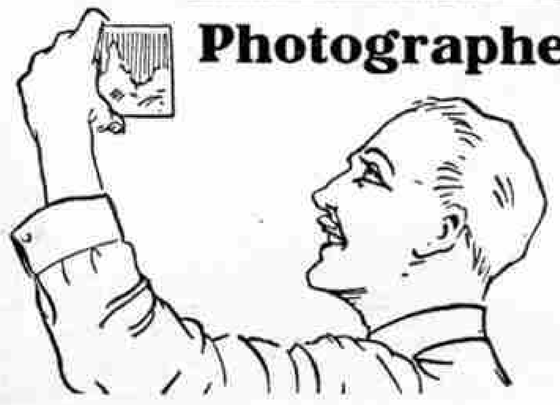

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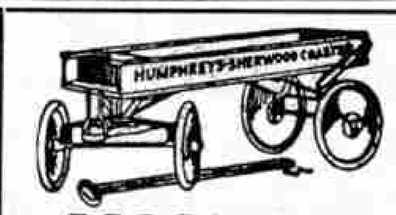

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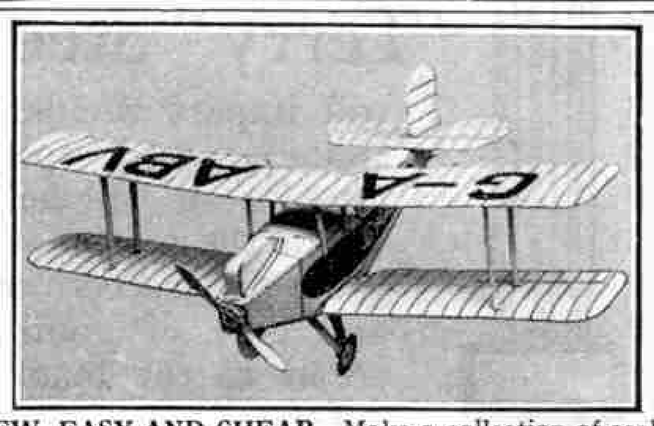

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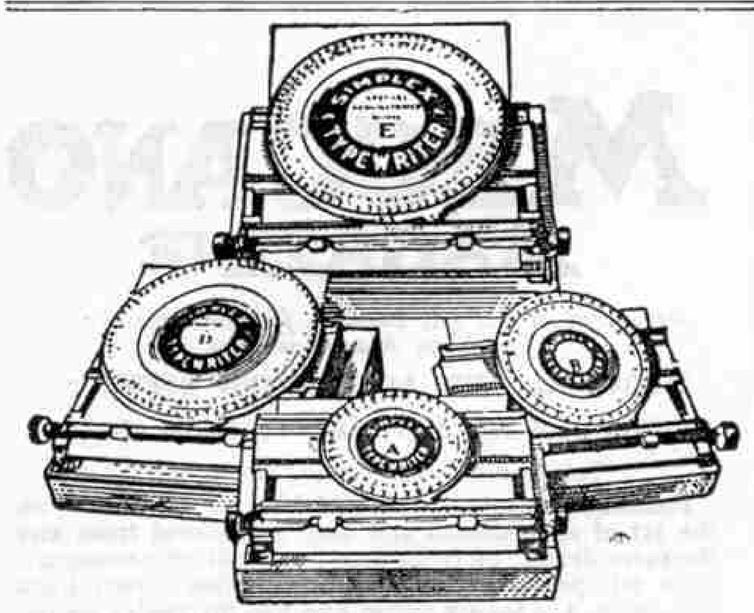

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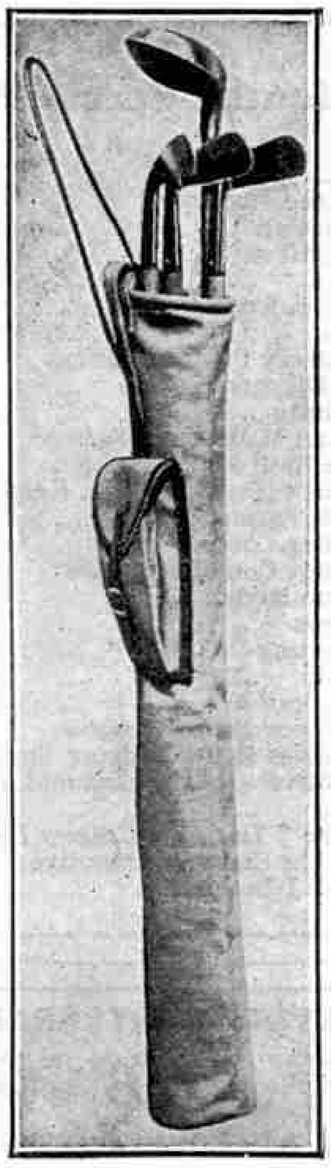

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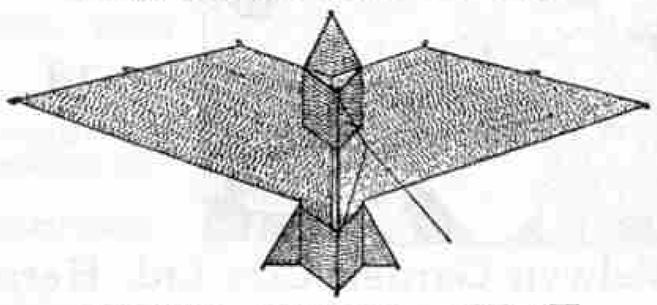

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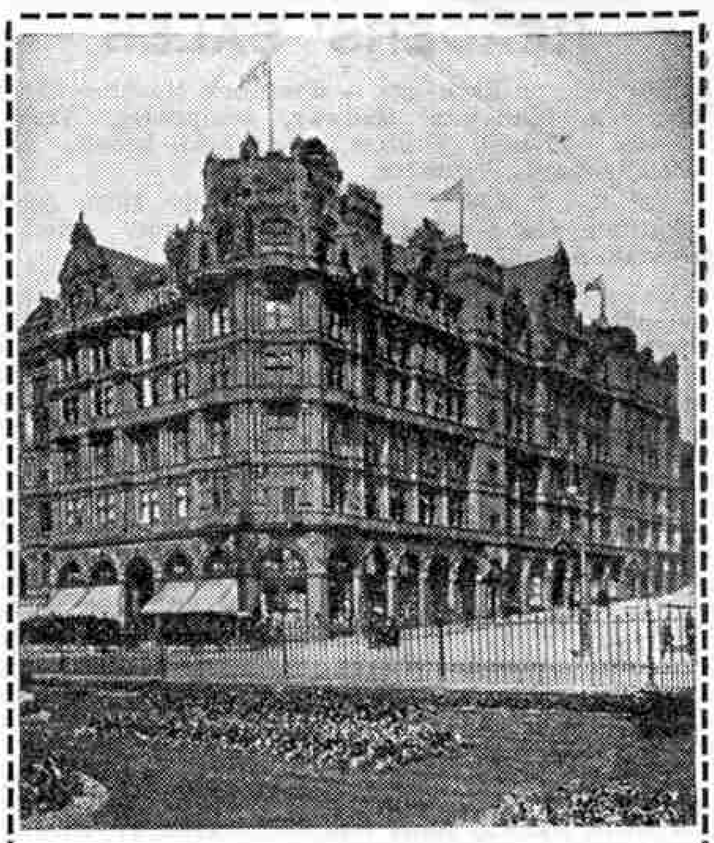

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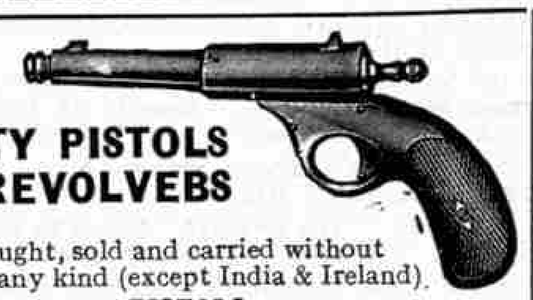

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	Page
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Fireside Fun	735
From Our Readers	702
Guild Pages	730–1
Hornby Railway Company Pages ...	718–729
In Reply—Meccano Section	715
Irvin Air Chute	696
Liverpool and Manchester Railway ...	678
Locomotive Built 92 Years Ago ...	684
Meccano Clock Nearly 10 ft. in Height	710
Motor Coach Passenger Station ...	685
Model-building Contest	709
Model-building Contests Results ...	706
New Meccano Models	716
Railway News	680
Stamp Collecting	737
Stamp Gossip	739
Suggestions Section	713
Sydney Harbour Bridge Progress ...	692
Telephone Talks from a Moving Train	682
The Locomotive—Its Development and Future	688
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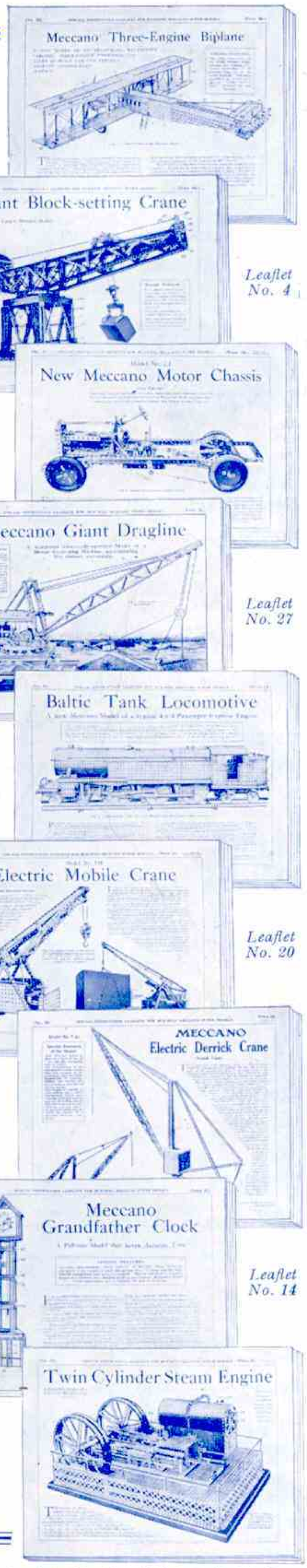

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No. 19a STEAM EXCAVATOR, OR MECHANICAL DIGGER. A Meccano Steam Engine is incorporated in this model and provides the power for operating the four movements.

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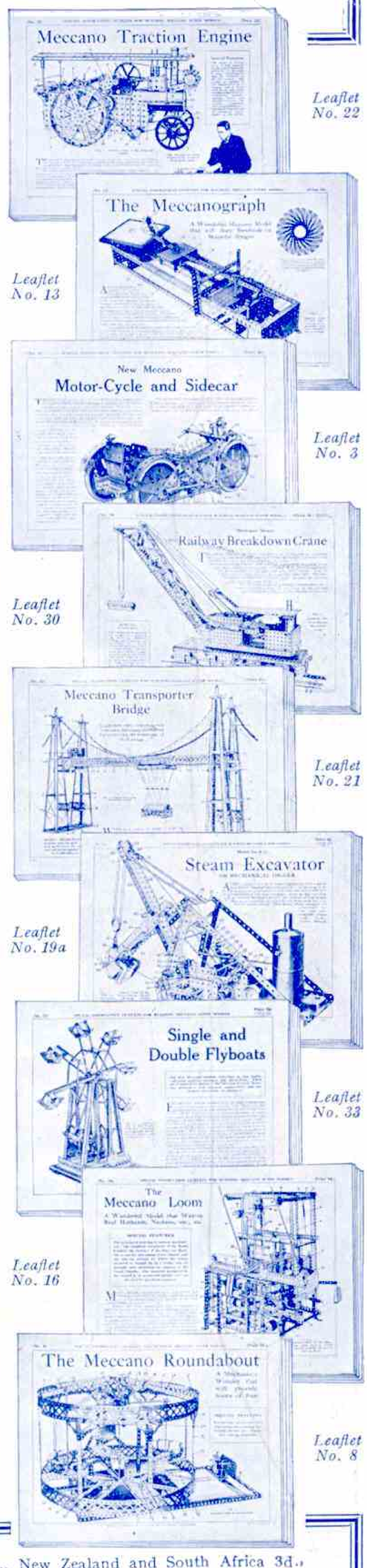

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Prices of Meccano Super Model Leaflets:—

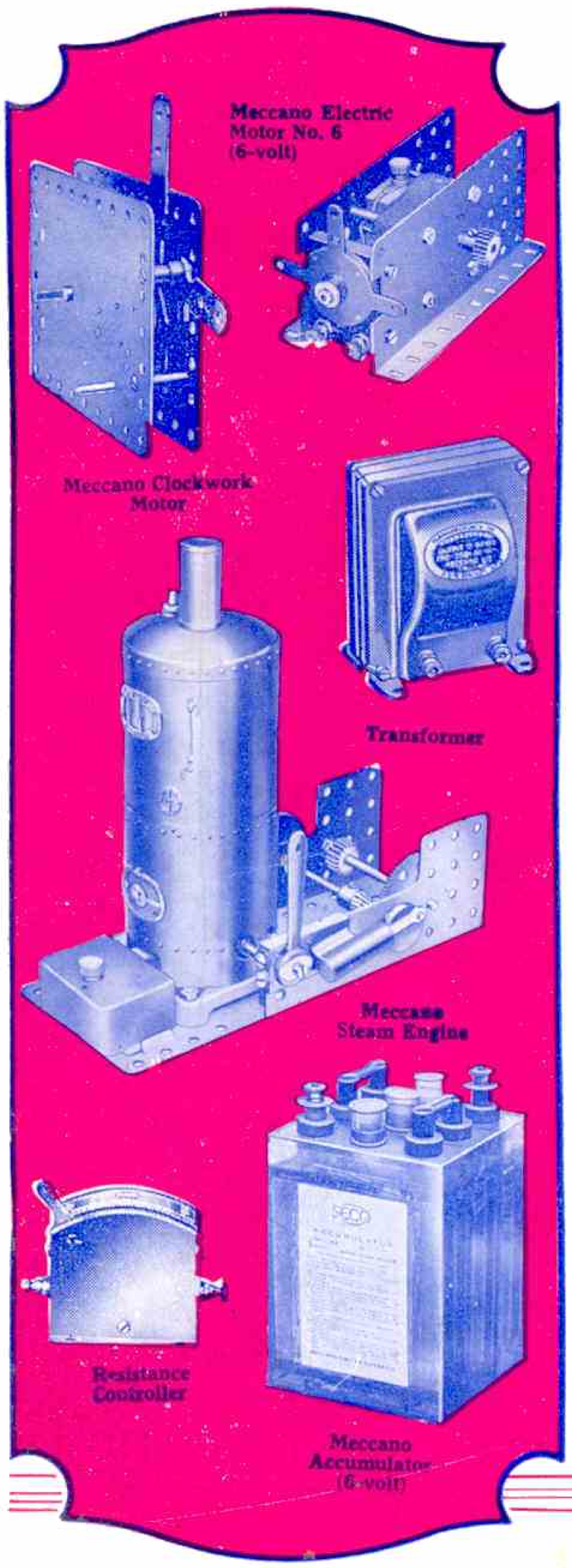
Leaflets Nos. 3, 5, 6, 7, 8, 9, 10, 11, 12, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 28, 29, 36—United Kingdom 2d., Australia 4d., New Zealand and South Africa 3d., Canada 5 cents.

Leaflets Nos. 1, 2, 13, 14, 15, 16, 19a, 27, 30, 31, 32, 33, 34—United Kingdom 3d., Australia 6d., New Zealand and South Africa 4d., Canada 8 cents.

Leaflet No. 4—United Kingdom 6d., Australia 1/-, New Zealand and South Africa 8d., Canada 15 cents.

MECCANO LIMITED - OLD SWAN - LIVERPOOL - ENGLAND

Run your Model with a Meccano Motor



If you want to obtain the fullest enjoyment from the Meccano hobby you should operate your models with a Meccano Motor or Steam Engine. You simply push over the control lever of the motor or engine and immediately your Crane, Motor Car, Ship Coaler or Windmill commences to work in exactly the same manner as its "big brother" in real life. Could anything be more exciting?

The Meccano Motors and Steam Engine are strongly made and the utmost care is taken in their manufacture to ensure that they will give satisfaction. The side plates and bases are pierced with the standard Meccano equidistant holes, which enables a motor or engine to be built into any Meccano model in the exact position required.

Particulars and prices of the Steam Engine, Motors and Accessories are given below

Meccano Clockwork Motor

This splendid Motor, which is specially designed for operating Meccano models, is a compact self-contained power unit.

An efficient governor controls the spring that is fitted on the motor and ensures a ong steady run at each winding. Brake and reverse levers enable the motor to be stopped, started and reversed as required. Supplied complete with winding key and full instructions. Price **7/6**

Meccano Steam Engine

This is a particularly powerful steam unit designed for driving Meccano models. On actual test it has lifted over 56 lbs. A single cylinder of the oscillating type is employed, steam being admitted to it through a special reversing block. Operation of the reversing lever enables the crankshaft, which is fitted with a special compensated flywheel, to run in either direction.

The spirit container for the lamp is placed well outside the boiler-casing, eliminating all risks of the spirit becoming heated. The boiler is fitted with an efficient spring safety valve of heavy gauge brass and there is no danger whatever of it exploding. Price **25/-**

Meccano Electric Motor E.1 (6-volt)

This highly efficient electric motor (non-reversing) gives excellent service. A 6-volt Accumulator will operate it, but it may also be driven from the main (alternating current only) through the Transformer described in the next column. Price **7/6**

Meccano Electric Motor No. 6 (6-volt)

This 6-volt Motor is specially designed to build into Meccano models. It may be run from a 6-volt accumulator or, by employing the Transformer described below, from the main. It is fitted with reversing motion and provided with stopping and starting controls. The gearing is interchangeable. Price **15/6**

IMPORTANT.—The Meccano 6-volt Electric Motors will not run satisfactorily from dry cells.

Accumulator (6-volt, 20 amps)

The Meccano Accumulator is of substantial construction and is specially recommended for running the Meccano 6-volt Electric Motors. Price **28/6**

Transformer

By means of this transformer the Meccano 6-volt Electric Motors may be driven from the house supply (alternating current only). It is available for all standard supply voltages, from 100 to 250 inclusive, at all standard frequencies. The supply voltage and frequency must be specified when ordering. Complete with length of flex and adapter for connection to an ordinary lamp socket. Price **30/-**

Resistance Controller

By employing this variable resistance the speed of the Meccano 6-volt Electric Motors may be regulated as desired. The controller is connected in series with the motor and accumulator, or with the motor and transformer if a transformer is used as the source of power. It will not regulate the speed of a high-voltage motor connected to the main. Price **4/6**

MECCANO LTD.

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